June
1933

Construction Methods

This Month:

STRUCTURAL FEATURES of Chicago's Century of Progress Exposition

SKYWAY at World's Fair formed by Tall Towers and Cable Track

PNEUMATIC TIRES on Heavy Earth-Moving Equipment

BLACK-TOP Resurfacing for Ohio Highway

BORING MACHINE for Underground Conduits

McGraw-Hill Publishing Company, Inc.

FEDERAL BUILDING, with three fluted towers, is one of the many unusual structures at Century of Progress Exposition, opened at Chicago this month.

Construction Methods

McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York
ROBERT K. TOMLIN, Editor
Editorial Staff: Vincent B. Smith, J. I. Ballard (San Francisco)
John W. Shaver (Cleveland), Nelle Fitzgerald
WILLARD CHEVALIER, Publishing Director

For Industrial Recovery

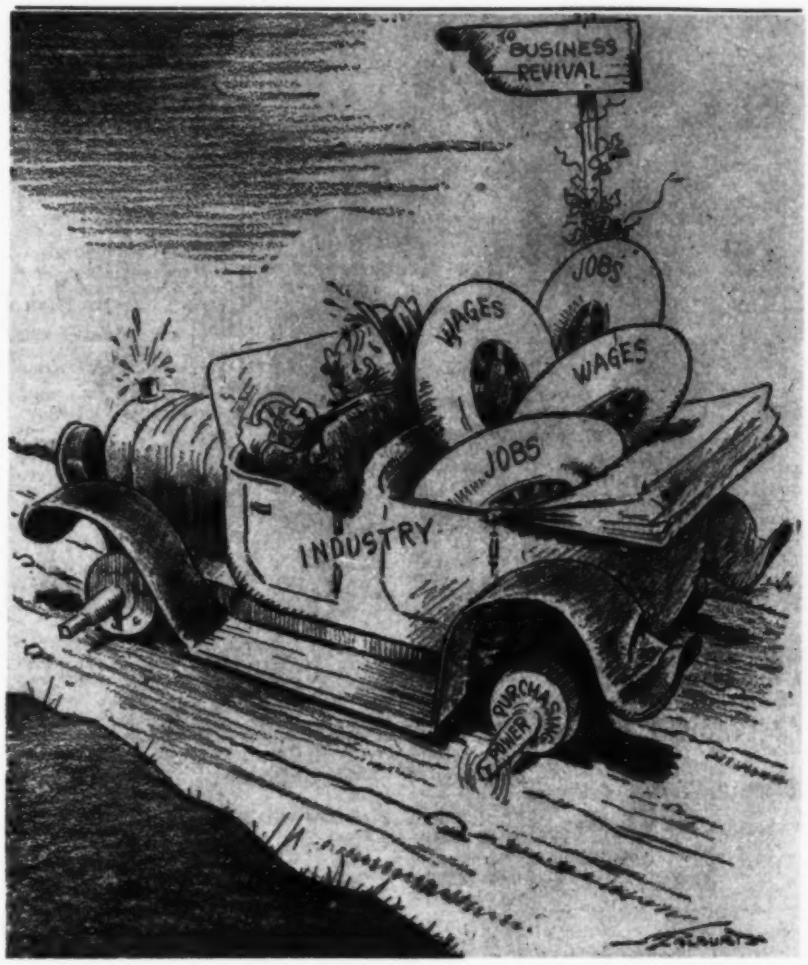
As these notes are written the National Industrial Recovery Bill is still pending in Congress.

Payrolls Instead of Promises

• Construction has been selected as the activating force in the nation's plan for industrial recovery. The $3,300,000,000 public works program proposed in the National Industrial Recovery Bill, however, is not an end in itself, but rather a means to an end. Business, generally, has been stagnant because of lack of purchasing power. Men out of jobs, with savings depleted or exhausted by months of unemployment, are poor prospects as buyers of the goods that must be manufactured and sold to keep the wheels of industry turning. The pending legislation, therefore, is intended, through construction on a vast scale in the field and its even more important train of related industrial activities in producing and transporting the materials and equipment needed for construction, to develop a country-wide buying power *quickly*. All indications lead to the conviction that the administration at Washington will not temporize in getting construction work started just as soon as Congress has given its approval. There will be no repetition of the delays and quibblings over details which largely nullified the usefulness of the Reconstruction Finance Corporation's program of self-liquidating projects. The passage of the recovery bill will mean payrolls instead of promises.

Direct Grant for Highways

• In the case of public highways the Industrial Recovery Bill goes a step further than for other public works projects, by authorizing a direct grant of $400,000,000 to be apportioned among the several states on this basis: three-fourths in accordance with the Federal Highway Act of 1921 (one-third area, one-third post road mileage, and one-third population) and one-fourth in the ratio which the population of each state bears to the total population of the United States. The special significance of this feature of the bill is that it will make immediately available for highway construction and grade-crossing elimination a large sum to which no strings are attached. There is no provision calling upon the states to match this money, as has been the practice heretofore on all Federal-aid highway projects. Instead, this $400,000,000 is given outright to the states to be put into circulation immediately through the building or widening of roads and bridges. For spending this money an efficient organization, in the form of the present state highway departments, is at once available. No time need be lost, once Congress has agreed upon the plan, in getting work under way. All of the states have deferred construction plans and programs ready, awaiting only the needed funds for their prosecution.



Talburt, in The Cleveland Press

Put the Wheels On!

IN its general purpose of launching a nationwide revival of business the National Industrial Recovery Bill has one objective that transcends all others in urgency and importance: To provide jobs for men now out of work. The legislation proposes a cooperative movement throughout all industry that foreshadows epoch-making economic and social changes, but essentially it is a reemployment measure, offered at a time of national emergency.

Broadly, the bill consists of two parts, one an industrial control section to establish fair competition, shorten the working week and insure the payment of decent wages, and the other a direct employment section embodying a $3,300,000,000 program of public works construction designed to release purchasing power and stimulate the capital goods industries upon which so much of our general employment and prosperity must depend.

Both major features of the measure are so closely interrelated that they must operate together, as a unit, if the full purpose of the recovery program is to be accomplished. The spending of large sums of money on public construction might prove a short-lived cure for present conditions unless it were accompanied by measures for eliminating unfair competitive practices and insuring united action of labor and management under adequate government supervision.

No Requirement of Self-Liquidation

• In the new recovery plan the functions of the R. F. C. are absorbed by the new Public Works Administration and former restrictions governing approval of federal loans for construction projects have been liberalized by eliminating the self-liquidating requirements. In fact, outright grants of federal funds, up to 30 per cent of the cost of labor and materials for each project, are authorized. Further, the burden of finding funds immediately for the remaining 70 per cent of the cost of local projects need not be borne entirely by state, county or city, for the measure specifically authorizes the President "to construct, finance or aid in the construction or financing of any public works project included in the program." Considerable latitude in this important feature is made possible, for the only stated requirement limiting the Federal Government's aid is that any federal loans for construction be "reasonably" secured.

Competition Not Abolished

• The purpose of the industrial control feature of the Recovery Bill, as Senator Robert F. Wagner interprets it, is "not to abolish competition, but to lift its standards, to eliminate destructive practices and competition in reducing wages and lengthening hours." Every dependable manufacturer of construction equipment or materials and every responsible contractor, as distinguished from the price-slasher and the jerry-builder, will agree with Senator Wagner's prediction that, with the bill approved, "efficiency, rather than the ability to sweat labor and undermine living standards, will be the determining factor in business success."

Health Safeguards for Rock Drillers

• A new type of portable dust-collecting machine, described in this issue, offers fresh evidence of the continued effort to devise apparatus which will remove from hard-rock drilling the hazard of silicosis, a lung disease caused by inhalation of rock dust. Utilizing the principles of the induced draft and fabric filter employed in recent machines developed for this purpose, the new unit places special emphasis on the practical features of light weight and portability. If further tests bear out the inventor's claims regarding increased drilling speed and reduction of dust concentration in the atmosphere, contractors may be expected to give small detached units of this type ample opportunity to prove their worth in actual service.

A Right and A Left

ATTENTION now is focussed on the progress of the National Industrial Recovery Bill. At this writing it has passed the House and before this page is in print it probably will have passed the Senate. It is important to emphasize here one aspect of the bill that frequently is overlooked.

THIS MEASURE must be considered as a unit. It is in two parts, but together these constitute one attack on our problem. They are a right and a left. Wielded effectively in cooperation they can knock out the depression; otherwise we must fight it with one hand tied behind us.

MOST ENGINEERS AND CONSTRUCTORS see clearly the importance of the public works section. It is the aggressive or activating part of the measure. It is designed to strike directly at unemployment, to release purchasing power and to stimulate the capital goods industries upon which depends so much of our general employment and prosperity.

BUT IF THIS STIMULUS is to carry through with a cumulative effect, the industry control section is equally necessary. It is designed to stabilize prices, restore the earning power of private industry and protect employer and employee alike against the destructive effects of the blind, cutthroat competition that has been bred by three years of panicky deflation. If the public works project is to be fruitful, industry must be put in position to thrive on the employment and purchasing power created by that effort.

LET ME PUT IT THIS WAY: the public works program is the boiler that will generate the pressure required to speed up the business engine; the industry control measure is designed to tighten up the joints in the steam-line and to put a governor on the engine, so that the power will not leak away and be dissipated through destructive competition and maladjustment.

BOTH ARE NECESSARY. Industrialists who are absorbed in the industry control plan should recognize that it can get them nowhere without the public works program to revive employment and purchasing power. Engineers, contractors and others should understand that the effect of the public works effort will be substantially curtailed unless a curb be put on the "chiseling" and other destructive trade practices that prevent the return of industry to a profitable basis.

IT WILL BE NECESSARY, therefore, to insure that the public works program be not made a dumping-ground for direct relief. It will not do just to scatter the present recipients of direct relief promiscuously over construction jobs to put in their time with picks and shovels. To accomplish its purpose, this construction work must be carried on by construction workers, through normal channels, and normal methods. Our objective is to put men back to work at their normal occupations, not to perpetuate breadlines thinly disguised as productive pay-rolls. Specifications must be prepared, contracts let and men put to work by normal and efficient procedure; thus alone can we stimulate employment that will be fruitful and permanent. Thus only will the bulk of the unemployed find their way back into the work for which they are best fitted and thereby take their places in the march back to prosperity.

MOREOVER, those who administer the public works section of this measure must be governed by the spirit of the industry control section. They must take care that they themselves do not foster "chiseling" and cutthroat methods. Their specifications must not impose abnormal restrictions that will make for waste and inefficiency, their contracts must not be awarded at prices that will exploit both employers and workers, they must guard against the evils of bid-peddling and all the other abuses against which industry control is directed.

If the government is going to control industry in the interest of fair competition, it may reasonably be expected to set an example to industry in its administration of the very act by which it exercises that control. It can make or break its effort as a lawmaker by its conduct as a buyer in the market-place for which it legislates.

Willard Chevalier

Publishing Director

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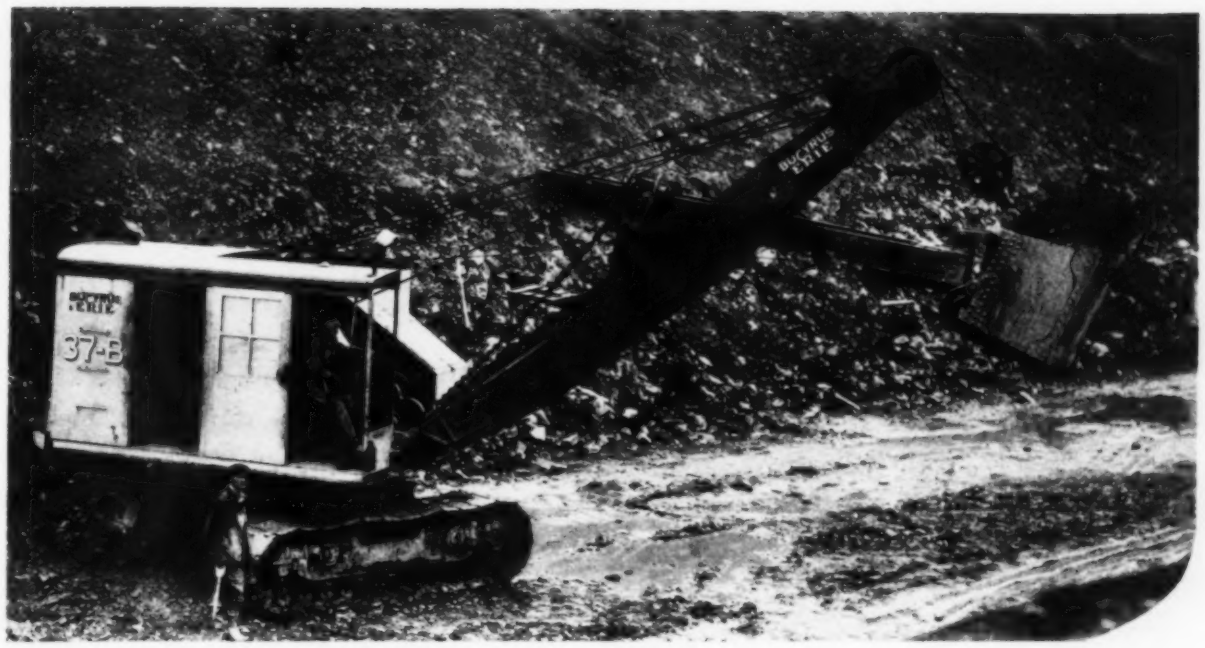

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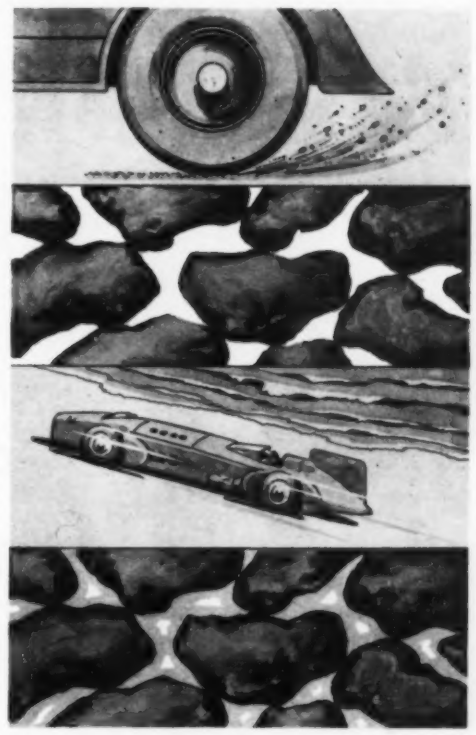
Q. ***Why does an automobile wheel do this to loose, dry particles of road materials?***

A. **Because there is no cohesive element to hold them together. Dry particles of soil, sand, gravel are unstable and slip over one another.**

Q. ***Why is a stretch of tidewater beach the fastest, smoothest, and one of the firmest roadways in the world?***

A. **Because a cohesive moisture-film connects each grain of sand with its neighbor . . . holds them together with a tenacity which exerts tremendous compression effects.**



The use of Calcium Chloride as a moisture-supplying agent is already widely known and adopted for dust laying, preventing heavy loss of surface materials and reducing maintenance costs on *any* type of unbonded road. On resurfacing work it has been proved to do an excellent job of stabilization with ordinarily available mixtures of gravel and soil fines . . . while the addition of correctly proportioned minute structure soils, such as clay, greatly increases the cohesive power of the moisture-film, to produce an unbelievably stable surface.

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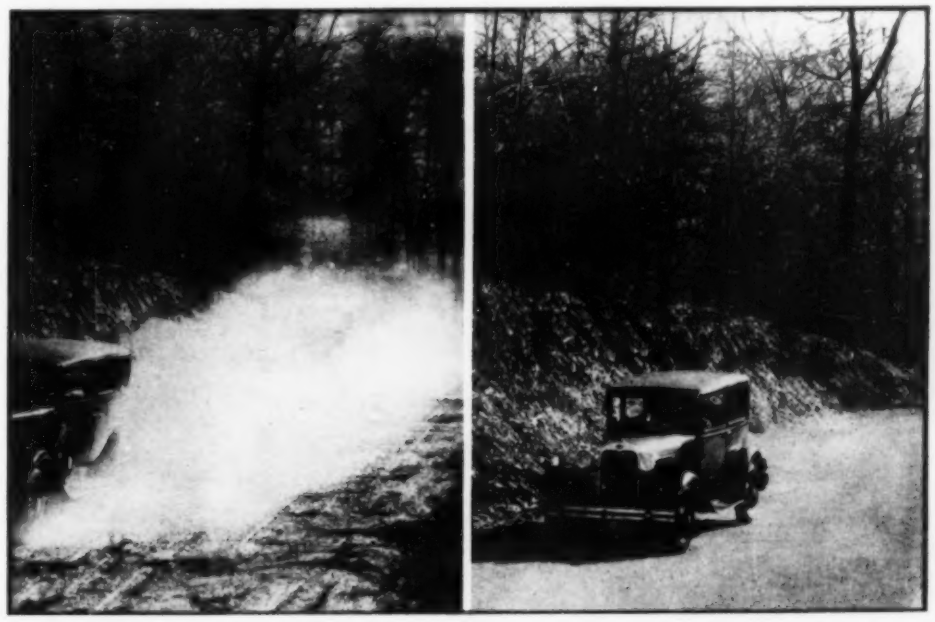

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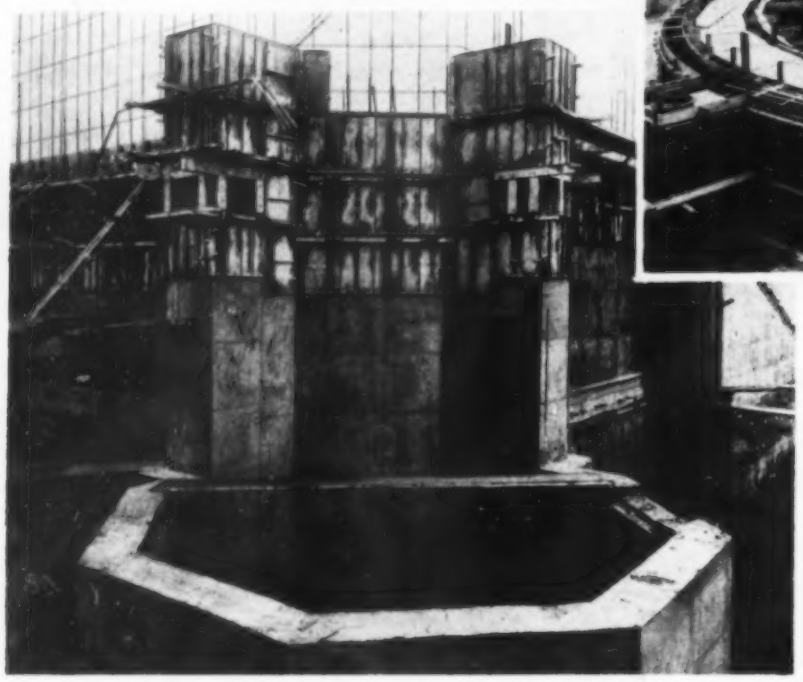
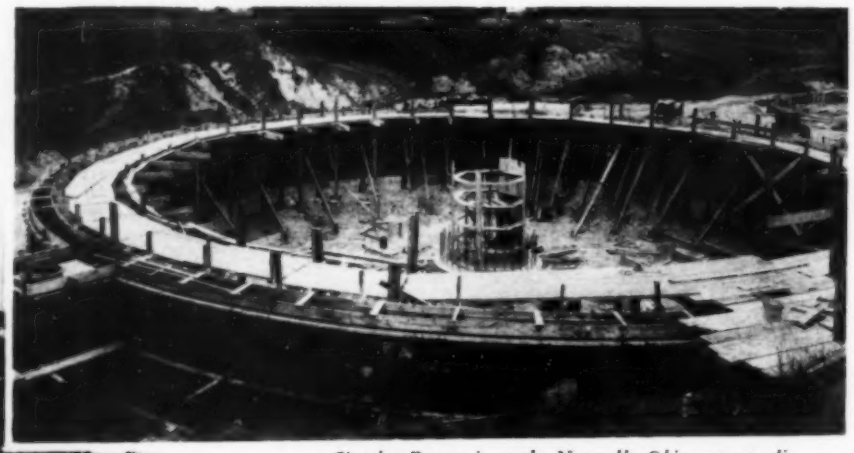


Octagonal Corner Guard Station in Great Wall of Lewisburg Federal Penitentiary

A very considerable amount of the concrete work in the Northeast Federal Penitentiary at Lewisburg, Pa., was of course straight away construction; but there was much detail work that holds interest for any contractor who works with concrete and who must consider his costs. We will gladly send information concerning this work to any interested contractor.

It will interest contractors figuring on such public work as circular reservoirs for water works or sewage disposal plants to know that circular forms are very readily and economically erected with straight wall Metaforms. Full information on request.



Circular Reservoir at the Norwalk, Ohio, sewage disposal plant, formed with straight wall Metaforms

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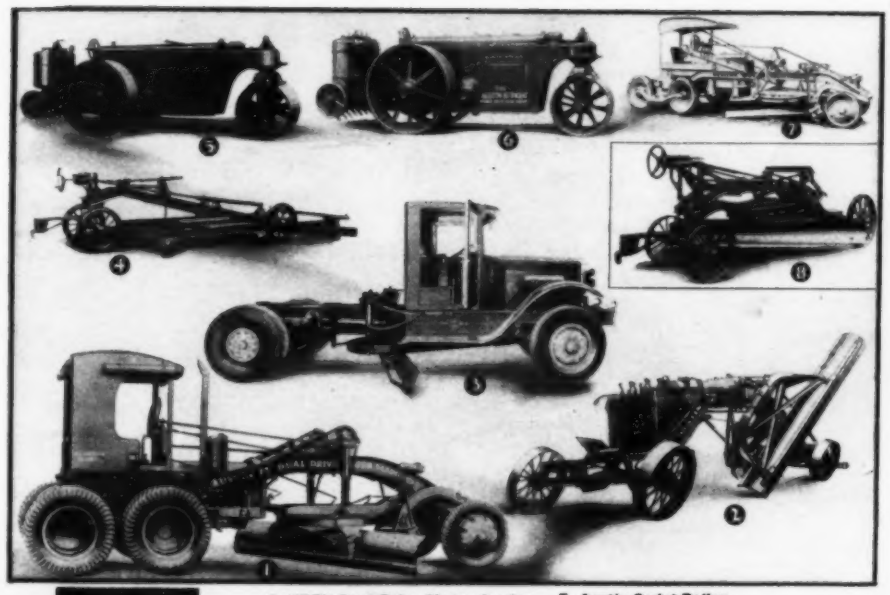

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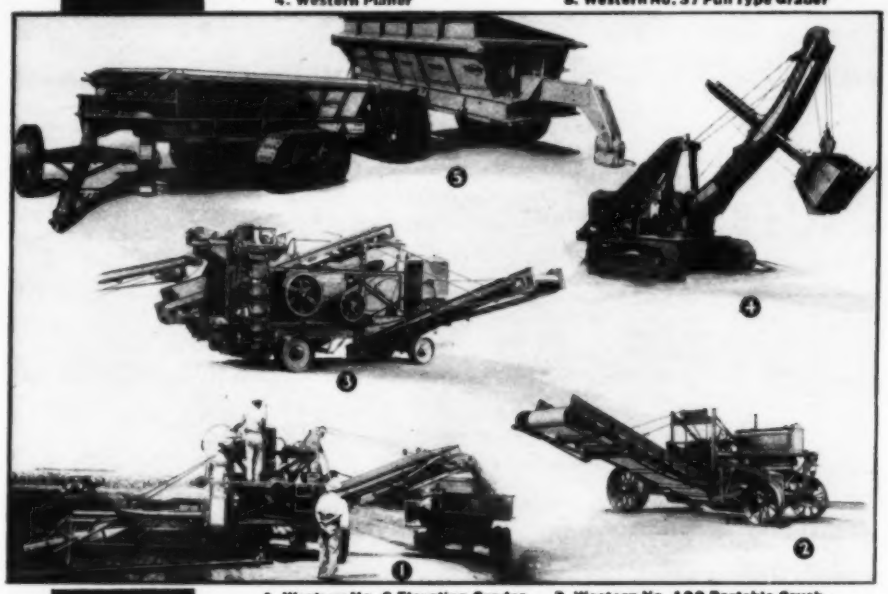

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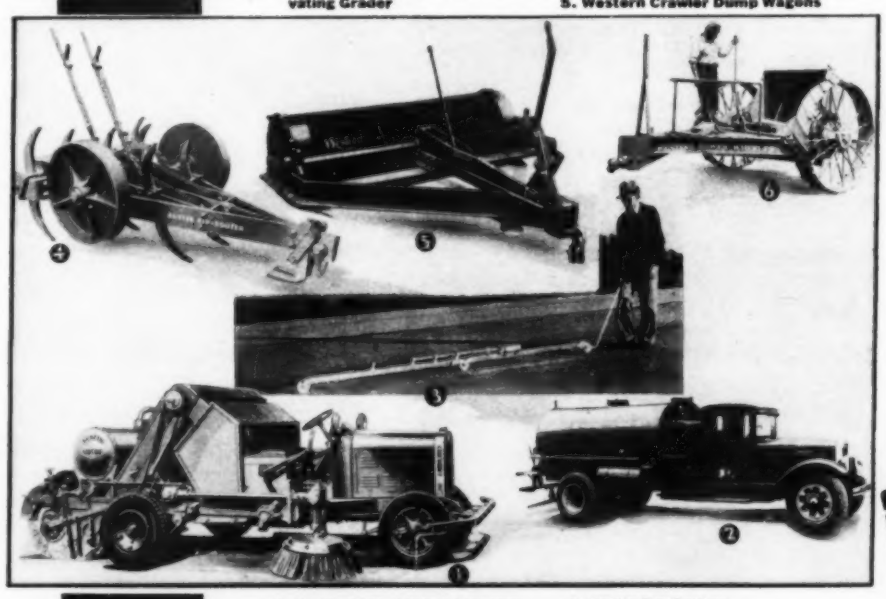

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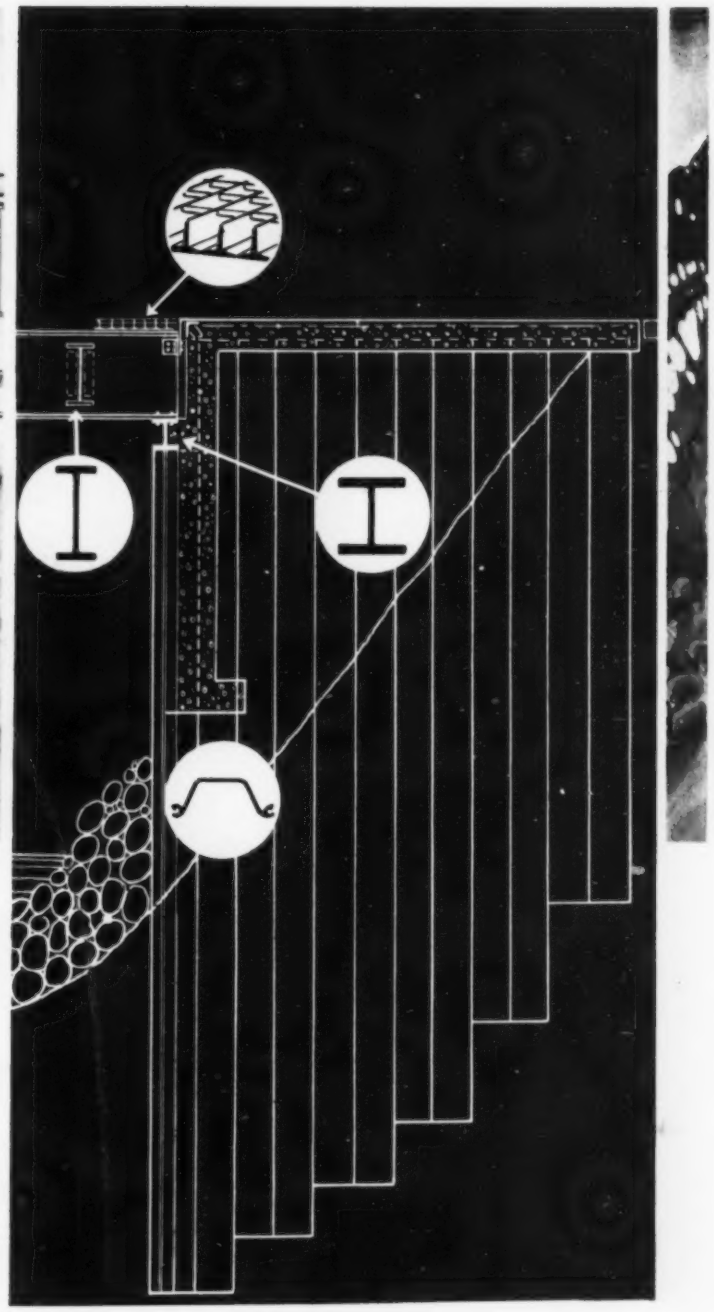

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Construction Methods

ROBERT K. TOMLIN, Editor

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Volume 15—Number 6—New York, June, 1933

FLEXIBILITY IN OPERATION which enables tractor driver to back scraper up against side of pit makes tractor-scraper outfit particularly adaptable to digging conditions in Murdock Construction Co. gravel-pit near Montevideo, Minn.

Tractor-Scraper Outfits

Produce Gravel Cheaply From Mid-West Pits

TRACTOR DRAWN scrapers are being used in increasing numbers for production of gravel in Iowa and Minnesota pits supplying material for construction of low-cost secondary roads. The tractor-scraper outfit has proved an economical unit both for digging the gravel and for the preliminary stripping of topsoil, which usually covers these pits to a depth of 2 to 4 ft. Where the length of haul in the pit is not too great, the tractor-drawn scraper maintains a satisfactorily high rate of production.

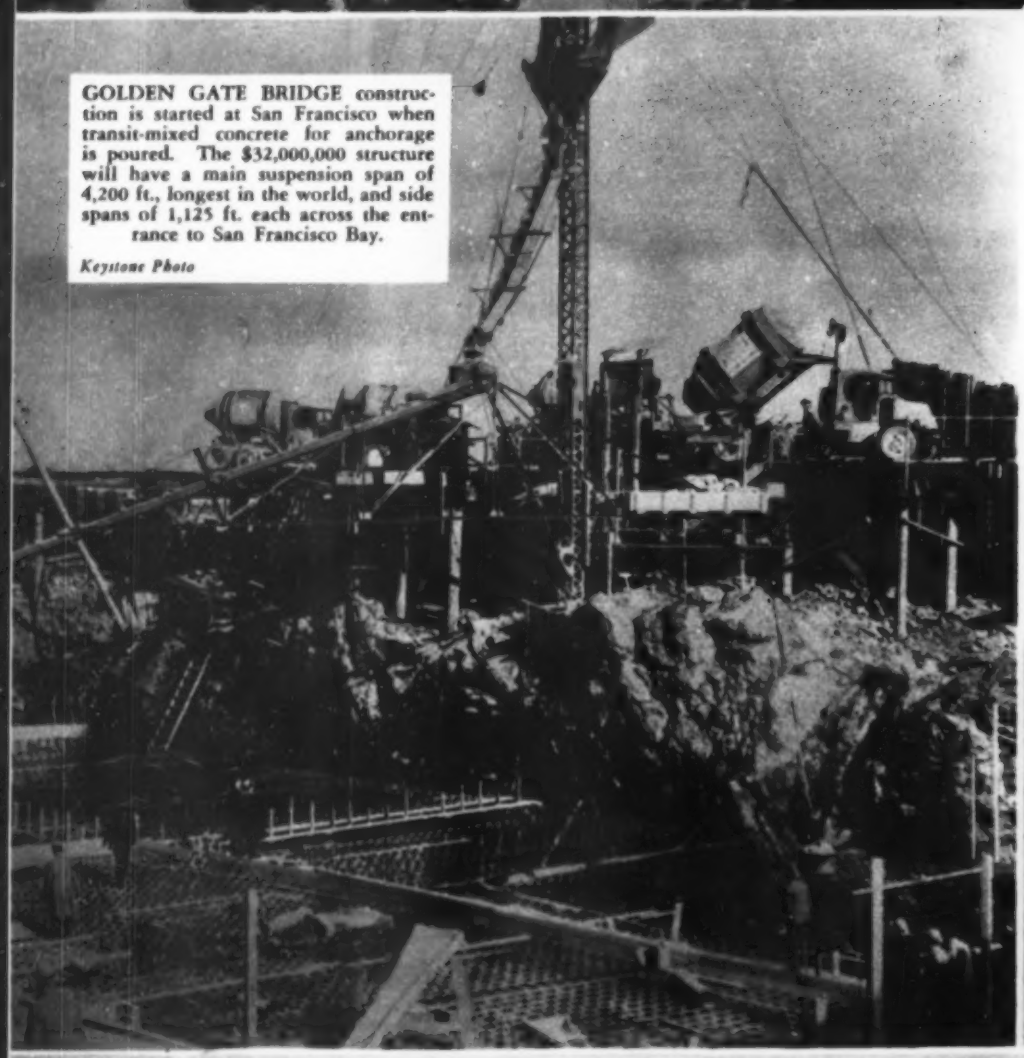
A number of contractors operate La Plant-Choate automatic roll-over scrapers attached to Caterpillar tractors for this work. The automatic roll-over scraper is equipped with control levers which enable the tractor operator to regulate the digging depth and to raise the cutting edge when the bowl is filled.

Several scrapers of this type were used by Beu & Sons to strip topsoil and dig gravel in a pit near Clear Lake, Iowa. A 50-cu. ft. scraper drawn by a 50-hp. tractor delivered about 2 yd. per trip and averaged a round trip every 3 min. on a 225-ft. haul. Two 1-yd. scrapers attached to 30-hp. tractors averaged a round trip every 2¼ min. on the same length haul and carried slightly greater than 1 yd. per trip. In another pit near Stewartville, Minn., W. K. Hodgeman & Sons averaged about 100 yd. an hour with two 42-cu. ft. automatic roll-over scrapers.

A BIG LOAD every trip with tractor-drawn scraper maintains production for Walter Stussy, near Rice Lake, Minn., and keeps equipment investment low.

Ability to turn in close quarters, quick dumping, and ample load-carrying capacity have contributed to the increased use of tractor-scraper outfits in Mid-West gravel pits. The operating flexibility of the equipment, which can deliver gravel from any part of the pit to the dumping hopper, eliminates need for auxiliary transportation units. Fast digging and traveling speeds of the tractor-scraper outfits, together with their wide operating range, add to their value for rapid opening of new pits. Complete one-man control of each tractor-scraper unit simplifies the organization of gravel-pit operations and places definite responsibility for maintenance of equipment and operating efficiency.

PRIZE-WINNING BRIDGE. French King steel arch over Connecticut River on Mohawk Trail, Massachusetts, wins 1932 beauty award by American Institute of Steel Construction for structures in $250,000—$1,000,000 class. Designed by Massachusetts Department of Public Works, A. W. Dean, chief engineer, and G. E. Harkness, bridge engineer. Contractors, Simpson Bros. Corp., of Boston, for substructure and McClintic-Marshall Corp. for superstructure.

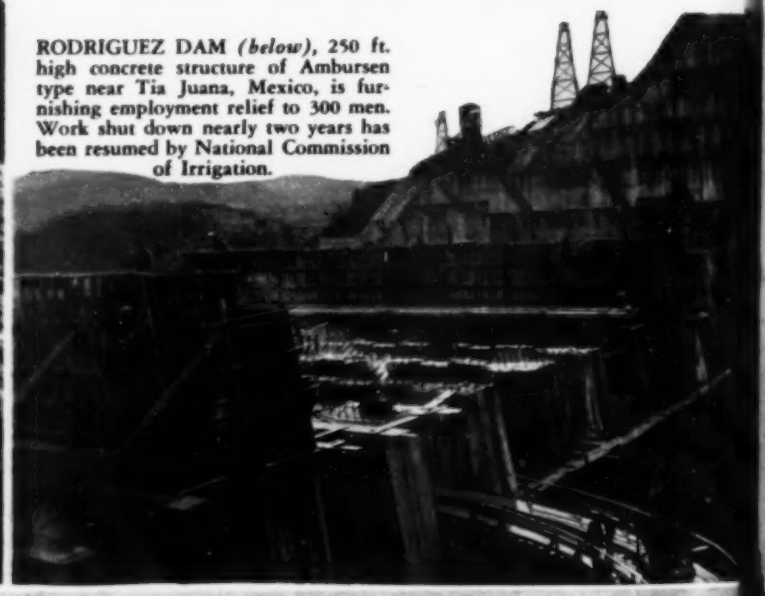


GOLDEN GATE BRIDGE construction is started at San Francisco when transit-mixed concrete for anchorage is poured. The $32,000,000 structure will have a main suspension span of 4,200 ft., longest in the world, and side spans of 1,125 ft. each across the entrance to San Francisco Bay.

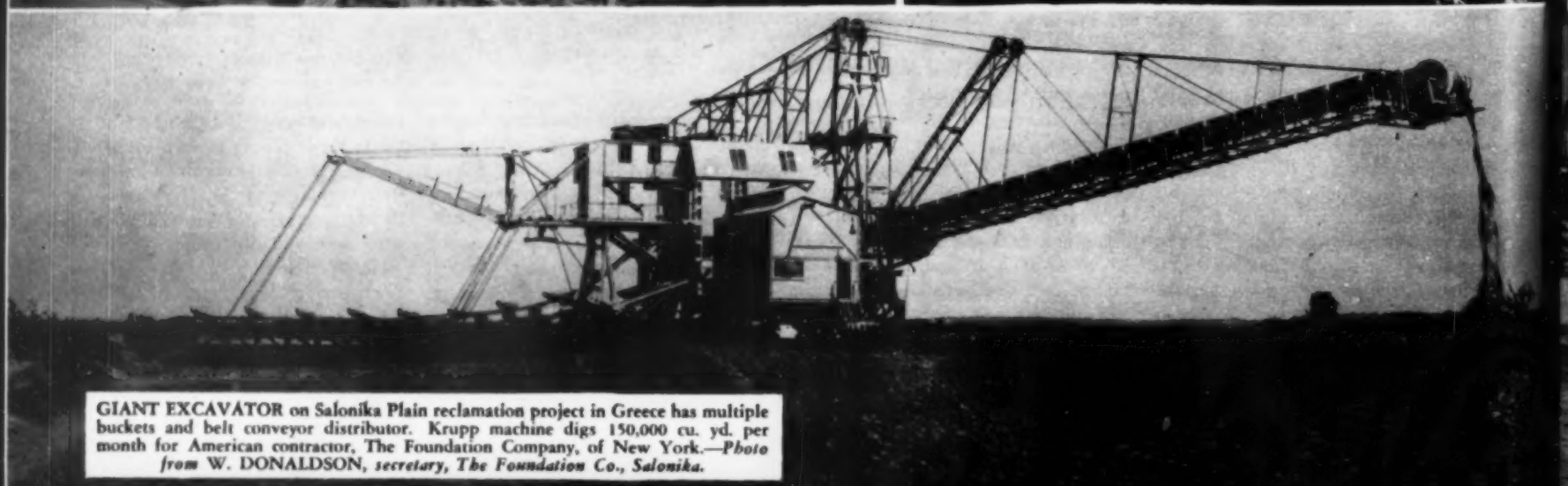
Keystone Photo

This Month's

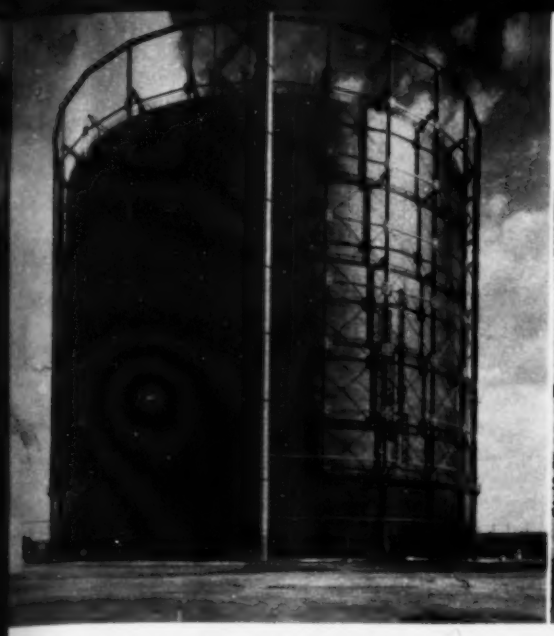
"NEWS REEL"



RODRIGUEZ DAM *(below)*, 250 ft. high concrete structure of Ambursen type near Tia Juana, Mexico, is furnishing employment relief to 300 men. Work shut down nearly two years has been resumed by National Commission of Irrigation.



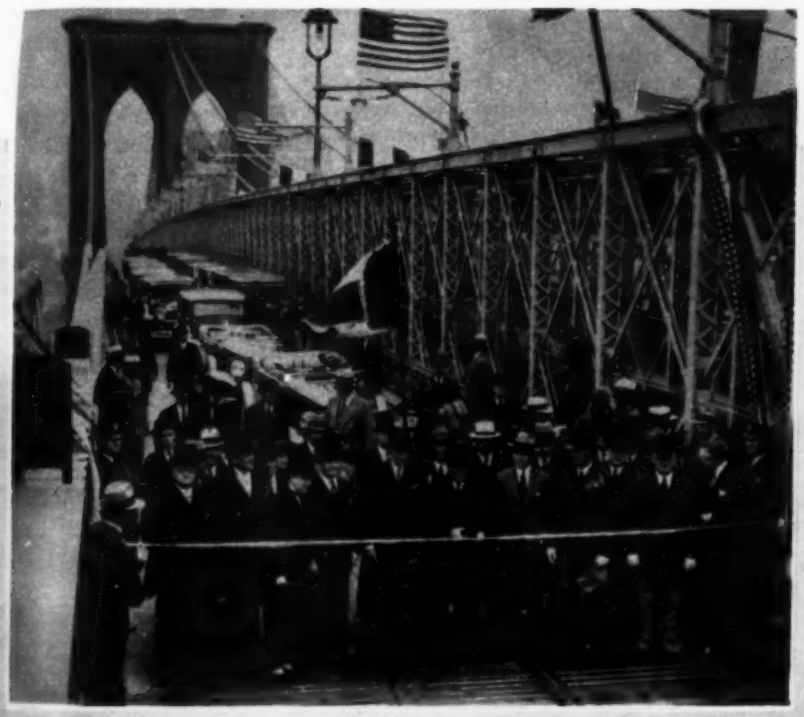
GIANT EXCAVATOR on Salonika Plain reclamation project in Greece has multiple buckets and belt conveyor distributor. Krupp machine digs 150,000 cu. yd. per month for American contractor, The Foundation Company, of New York.—*Photo from* W. DONALDSON, *secretary, The Foundation Co., Salonika.*



BIG GAS HOLDER, with 10,000,000-cu. ft. capacity, is erected by McClintic-Marshall Corp. for Philadelphia Gas Works Co. Five-lift, water-sealed structure has tank with diameter of 264 ft. 8 in. and frame of 26 columns with 7 tiers of struts. Electric welding was employed on tank bottom and frame columns. All rivets in tank shell, some of them as large as 1⅞ in., were driven cold. Elevator runs from ground to top of guide frame.

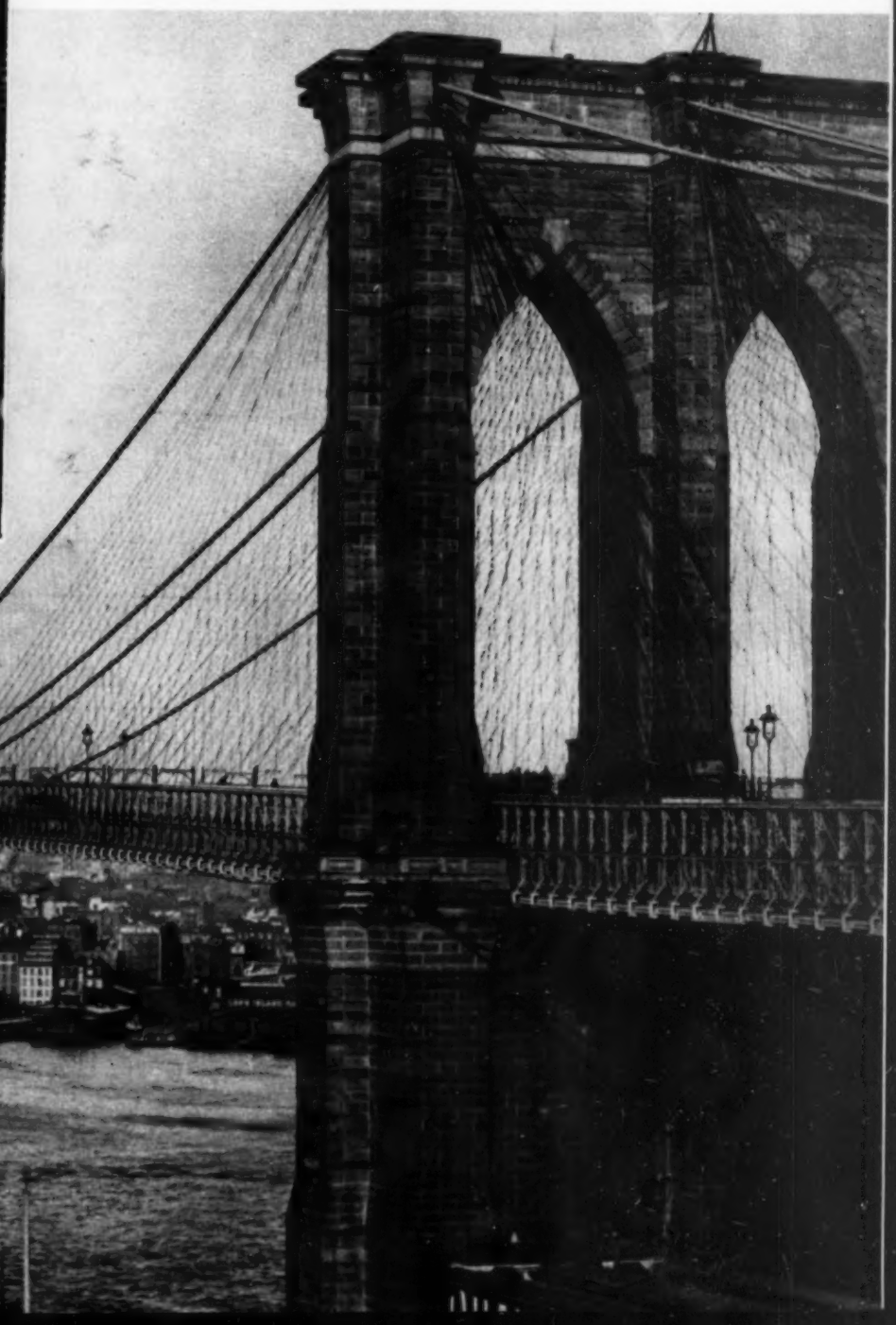
MISSISSIPPI RIVER LOCK NO. 20 at Canton, Mo., being built for War Department by Maxon Construction Co., Inc., of Dayton, Ohio, has reached stage where panel forms are in place within 13-acre cofferdam for foundation lift of lower guide wall. Concrete mixed in two 1-yd. plants is delivered by train in bottom-dump buckets and distributed by whirley cranes. Rock excavation totalled 82,000 cu. yd.

International



FIFTIETH ANNIVERSARY *(below)* of opening of Brooklyn Bridge spanning East River, New York City, is marked by civic ceremony May 24. World famous structure, completed in 1883, has main cable suspension span of 1,596 ft. supported by 276-ft. masonry towers, affording river clearance of 135 ft. at center. The building of the Brooklyn Bridge, product of the genius of John A. Roebling and his son, Washington A. Roebling, marked a new era in the use of steel wire suspension cables and of pneumatic caissons for pier foundations. MAYOR JOHN P. O'BRIEN *(left)* of New York reenacts ceremony of "opening" bridge to traffic after its half-century of service.

Underwood & Underwood Pho



ELECTRICAL GROUP of buildings at Century of Progress Exposition, looking across lagoon from Hall of Science.

WORLD'S FAIR BUILDINGS

Develop New Materials and Methods of Construction

NEW principles of construction and new materials have been given a practical tryout in building Chicago's 1933 World's Fair —A Century of Progress Exposition — officially opened this month. This World's Fair is different from anything of the past. The architects and engineers have been free to use new methods and materials not possible in everyday commercial construction jobs.

A number of different factors govern building construction in this Fair. The structures are designed for temporary use only. The Exposition is located on property controlled by the South Park Commission and when the Fair ends, the buildings must be removed. The freedom from standard city building code restrictions enabled the designers and material manufacturers to develop certain ideas which, in themselves, may not be directly applicable to permanent construction but which may suggest methods and materials that can be used for permanent construction to speed up building time and reduce building costs.

The Exposition is building its larger exhibition structures for an average of 16c. per cubic foot. This includes all construction, lighting, ventilating and landscaping adjacent to the buildings. It does not include plumbing and heating. The plumbing is let out as a concession and since the Exposition will last only from June 1 to Nov. 1, 1933, no provision for heating the buildings is necessary.

The necessity for demolition is an important factor. This was considered in the selection of materials having a high salvage value and in following construction methods that will permit easy removal of the structures.

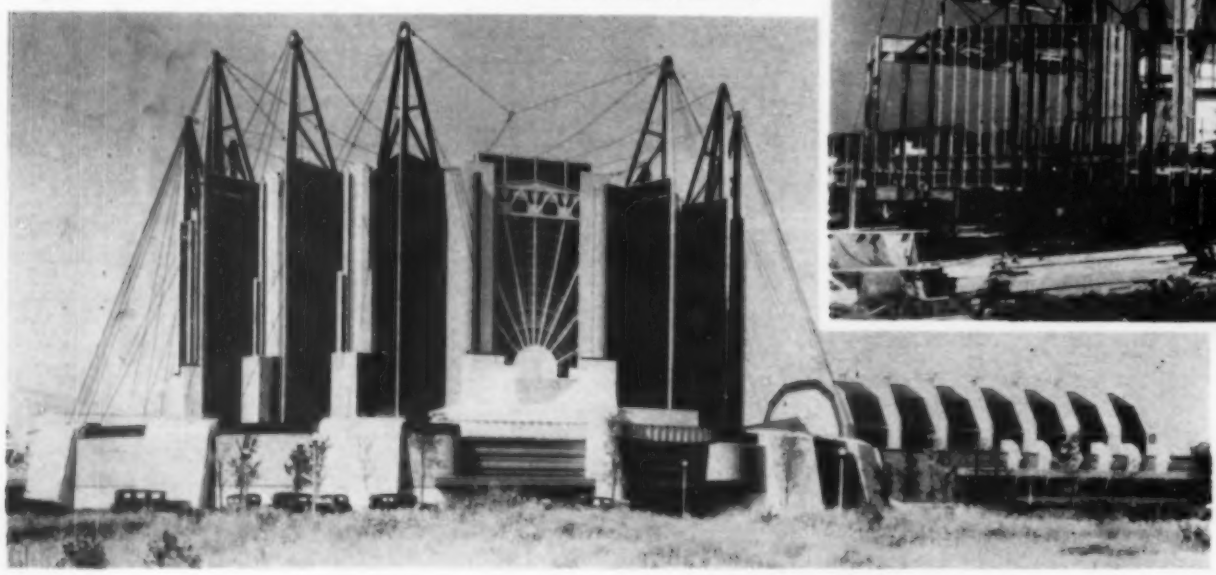
Throughout the development only such materials as conformed to a definite fire restriction were employed. This has permitted the use of exposed structural steel, with wood stud curtain walls when protected inside with an incombustible wall covering and outside with a slow-burning wall covering. The general layout of the exhibit buildings is planned as a multiple of unit spaces developed to satisfy both economical framing costs and most suitable exhibit space divisions.

Since there are a number of innovations in the design and construction of the Exposition buildings, it has been thought best, for the purposes of this article, to consider the various operations by classes, such as "foundations", "steel framing", etc., and to describe the new methods in each class:

Foundations—Some highly significant departures from standard founda-

FLUTED TOWERS, 150 ft. high, rise above central dome of Federal Building.

CABLE-SUSPENDED DOME *(below)* forms roof of unique design for Travel and Transport Building.



tion practice have been made—departures that have resulted in important economies. The ground on which the Fair stands is all "made" land, which a few years ago was fathoms under the surface of Lake Michigan. It varies from rubbish fill to good sand. Thus the buildings are designed to rest on pile foundations.

Instead of following the general practice of using a minimum of three piles under any column, the engineers developed a system of one- and two-pile footings. Thus, single piles are used under columns along exterior walls, with a wall beam supporting the wall at grade to resist any eccentricity of the pile in relation to the center of the column. The columns are so placed that the strong direction of the column is utilized to resist eccentricities normal to the wall. On the interior columns a minimum of two piles is used, with the piles so placed as to resist eccentricities about the weak axes of the columns.

A further saving in piling has been achieved by cantilevered concrete girders extending over and beyond the piling under columns and which carry walls set away from columns and likewise stair construction.

Steel Framing — The general arrangements of panel spacing of the framing for Fair buildings provides heavy steel girders extending across the width of the building. Together with the columns, these form strong bents for the structural bracing of the building. The successful development of lightweight wall covering (described later) was dependent entirely on this steel frame construction, since it provided rigidity to the building which the wall covering could not contribute. The bracing value has been developed for typical story heights by using a web

EXTERIOR COVERING *(left)* for Electrical Building consists of gypsum board protected by aluminum paint.

WELDING *(right)* was used on steel truss joists supporting roofs and floors of exposition buildings.

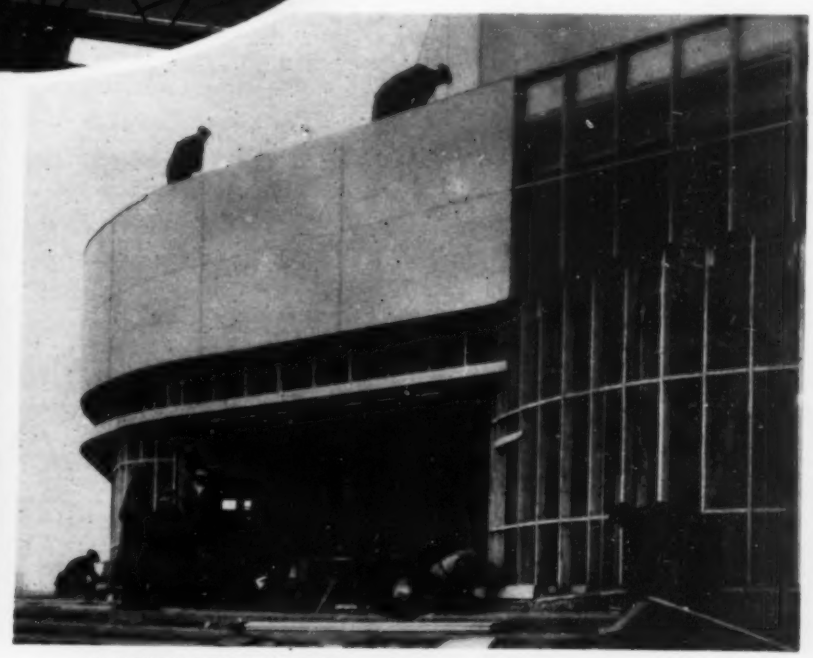
connection of girders to column, placed as high as possible on the girder, and by providing a seat angle connection of the girder to the column. These typical connections are bolted.

Towers and high pylons are braced generally with vertical struts and horizontal and diagonal cross-bracing. Steel joists used are of an open-trussed type. These are adapted to forming a safe, rigid floor construction by stiff cross-bridging, rigidly attached to a joist, and by special clamps designed by the engineers. The possibility of using exposed steel for decoration in interiors has also resulted in added economy by eliminating coverings around the framing.

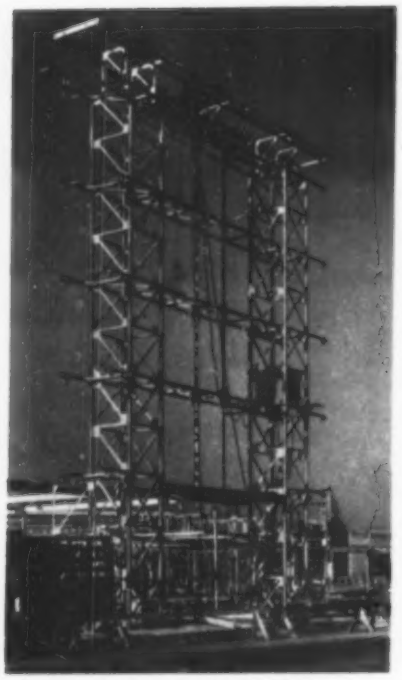
The live load for framed floors has been set at 100 lb. per square foot. Live loads for floors resting on the ground has been set at 400 lb. per square foot. Thus, exhibits of heavy machinery or other loadings will logically be placed on the ground floor. However, the flexibility of this type of steel joist construction will make it possible for loads exceeding the 100 lb. requirement to be placed on framed floors by the insertion of additional framing in the areas where the additional load is imposed.

Deck Construction — A variety of new floor-deck constructions have been developed, all of which are suitable for use over the steel trussed joists. The first material tried was a ribbed metal decking, such as has been hitherto used for roof construction only. This material consists of shop-fabricated channel sections laid flat. Tests indicated that it could be used to sustain adequately the live loads required over steel joists spaced not to exceed 24 in. on centers when of a weight not lighter than 18 gage. Experimentation, moreover, produced a type of mastic floor covering that yielded a satisfac-

FLOORING of sheets of five-ply fir plywood is supported by system of steel truss joists.



GYPSUM WALLBOARD on timber studding forms exterior walls of Dairy Building.



ENTRANCE TO FAIR GROUNDS on Twelfth St. has towers of structural steel.

tory, economical floor finish over this metal decking.

A more recent development also proved that the metal decking is suitable to receive a wood floor finish by connecting the wood floor to the metal decking by attaching the flooring to shallow metal channel runners secured to the metal decking by means of drive screws. The wood flooring is then clipped to the metal channel runners so that the entire finished floor is laid without nails. This will result in virtually a 100-per cent salvage of the wood flooring. It means also a saving in labor, since the construction is much speedier than by traditional nailing.

The second type of deck developed was a plywood of 5-ply Douglas fir, mill cut in large panels to suit the floor areas and joist spacing. These plywood strips are usually 3 ft. wide for easy handling and vary in length from 8 to 12 ft. The five plys are glued with an insoluble, exceedingly strong glue that makes the ⅜-in. decking stronger than single 1-in. thicknesses of solid wood decking. The joints are tongue-and-groove to make the separate panels set together. This decking is installed by nailing to treated wood nailers, securely attached to the top of steel joists. This decking also can be suitably covered by a mastic floor finish and with wood finishes either nailed or cemented to the decking. The rapid laying of these panels results in definite labor economy.

The third type of decking is a No. 1 grade of tongue-and-groove flooring of a minimum 1¼-in. thickness, laid on treated wood nailers. This decking serves both as a structural deck and a finished wearing surface, the minimum thickness being sufficient for a safe amount of wear on the top surface.

Roofs—Ordinary roof decks are covered with asphalt composition roofing over insulation board used to keep out the summer heat. For economy, flashings are generally of saturated fabric. Copings are generally but 4 in. high to reduce parapet wall costs and to permit the snow to blow off in winter. Roof felts are carried up and over the top to form coping covering, turned down on the face of the wall behind an exposed wood facia. This makes a very low cost construction permissible because of the short life of the buildings.

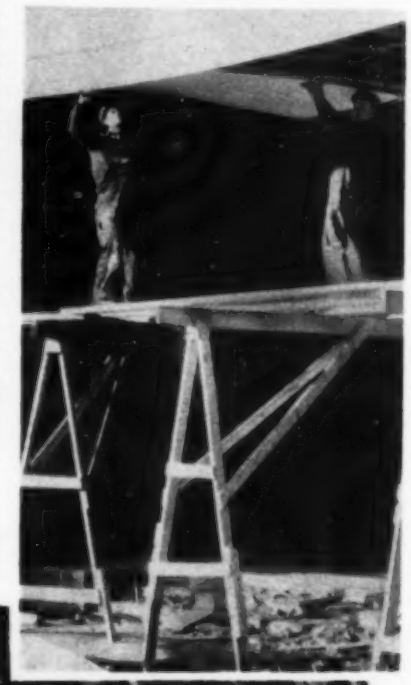
Exterior Wall Coverings—Exterior wall coverings of an unusual nature have been developed, with an increasing ratio of economy as newer materials were employed. In general, two types of wall covering have been used. One consists of a ribbed metal exterior wall siding. The other type consists of three different kinds of shop-made wall covering panels.

The metal wall siding consists of 20-gage siding, shop-fabricated in long lengths of interlocking channel shapes, set vertically with the flat flush surfaces to the exterior and the ribs resting against and clipped securely in place to horizontal steel girts, framing between the columns.

The other shop-made wall covering panels comprise asbestos cement board, Douglas fir plywood and aluminum-painted, paper-covered gypsum wall board. These coverings come in panels 4 ft. wide by 8 or 12 ft. long. They are nailed to wood or metal studs, forming curtain walls supported on the steel framing or held in place without nails in metal runners which are secured to the wood or metal studs. Curved surfaces to 10-ft. minimum radius are bent in place and to 4-ft. minimum radius are shop bent and delivered in protecting frames.

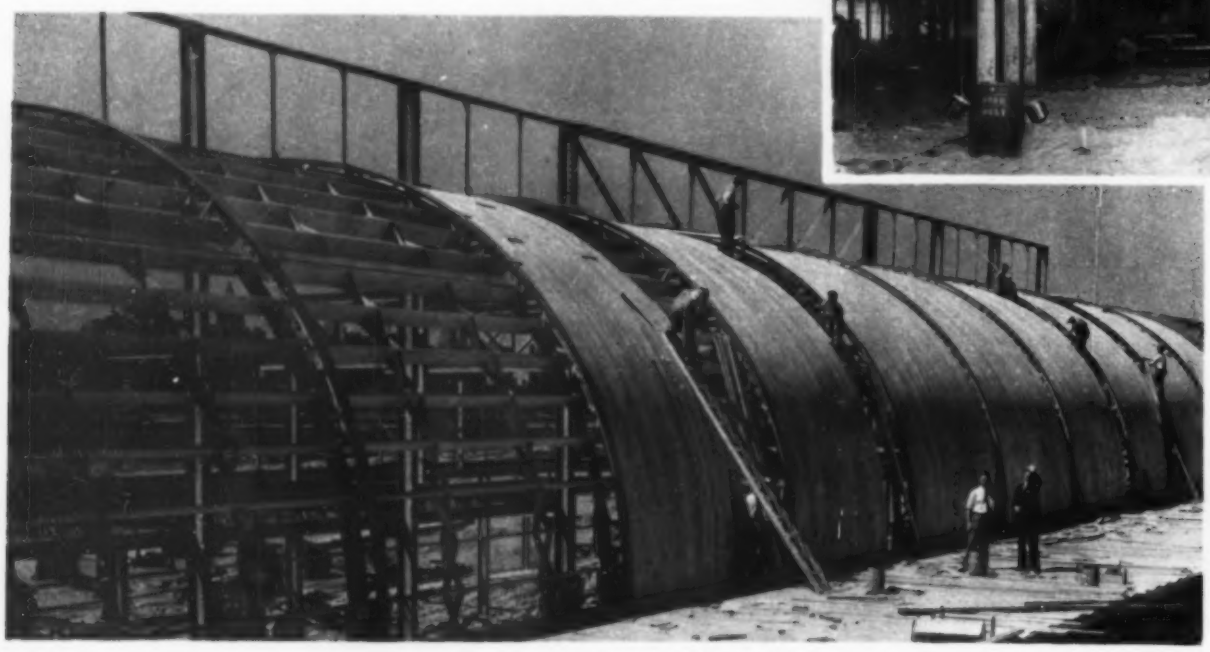
The asbestos cement board is a ¼-in. thick composition product. As this board expands and contracts an appreciable amount, the vertical edges were held against the studding with stiff metal cover strips fastened to the stud between the edges of the board, permitting movement.

The Douglas fir plywood wall covering is virtually the same as the floor decking previously described. Experimentation revealed that it would withstand exterior exposure if the joints or edges of the board could be made



CEILING PANELS *(right)* in large-sized sheets are hung from under-side of steel joist floor system.

STEEL TRUSS RIBS *(below)* form main frame for Agricultural Building.



HALF-BARREL VAULT of Agricultural Building is sheathed with wood on system of plank joists.

watertight. The panels come in ½-in. thicknesses, sanded and treated at the mill with hot linseed oil and white lead pigment. The jointing was made by half-lapping the edges, each edge being cut at the mill to lap, the horizontal joints lapping to weather. The lapped joints were given another coat of white lead and oil as erected, the board being attached to the studs with cement coated nails through the lap.

The paper-covered gypsum wall

board was decided upon following experimentation which revealed that a ½-in. board somewhat stronger than is commonly used for interior wall covering would have ample strength for exterior application, and that if the boards were painted over all at the mill with aluminum paint before delivery and were properly handled until placed on the wall, exposure to the elements did not damage them. These boards are nailed to the stud or held by metal runners which clamp the board and are secured to the studding. Horizontal joints are tongue-and-groove and all joints and metal runners are filled with mastic to make them watertight.

On the Electrical Group and all later buildings, including the General Exhibits Group, the Agricultural Group, the Dairy building, the Hall of the States, the Federal building, etc., this wall board forms the exterior covering, with a very appreciable saving in cost compared with the other coverings described. At the beginning of the work the others were considered extremely economical. Some use of the other materials is still made to obtain contrasting surfaces to suit the architectural design requirements.

While these various wall coverings will not prove suitable for general permanent building construction of the future, certainly the use of prefabricated wall units of suitable life expectancy, wearing and weathering qualities, which can be placed into the wall construction with a minimum of field labor and a considerable saving in time of completion, should result from the apparent successful demonstration of this Exposition's construction.

Interior Wall and Ceiling Covering—A ⅜-inch paper-covered plaster board is used almost exclusively throughout for interior walls and ceiling covering, as this material is entirely incombustible and provides the required fire resistance at the least cost. This board, typically 4 ft. wide by 12 ft. long, set vertically to typical 12-ft. ceiling heights, is nailed to the studding or ceiling furring. By using a close spacing of nailing, neat exposed joints are obtained without covering. This board is also used in narrower widths and lengths, generally 2 ft. wide for ⅜-in. thick and 2 ft. 8 in. wide for ½-in. thick in long lengths for the height of the room if set vertically, or as required if set horizontally, with the long edges held by a clamping metal runner that is attached directly to the studding. The metal runners form exposed projecting batten effects, in pattern.

Ventilation—The Exposition buildings are generally windowless as a result of planning the lighting of exhibits so that they will have the same effects throughout the day as at night, without contrasting light from windows. This requires a ventilating system throughout the buildings which has been developed and is very economical yet effective in operation.

Exhaust ventilating fans are located in small fan rooms throughout the buildings, so arranged as to withdraw the air through openings in the ceiling and floor deck. This space thus acts as a horizontal duct leading to the fan rooms. Thus only a small amount of metal duct work is required from this ceiling space to the fans and from the fans to wall outlet louvres. The use of the open steel truss joints greatly facilitates the free ceiling space. Ample fresh air will be obtained through the entrance and exit openings which will always be entirely open during the Exposition. Each floor level is independently connected to fans, so that fire stops can separate wall constructions at each floor level.

Special Features—In addition to the foregoing construction methods and utilizations of new materials, some special features have been developed which deserve attention:

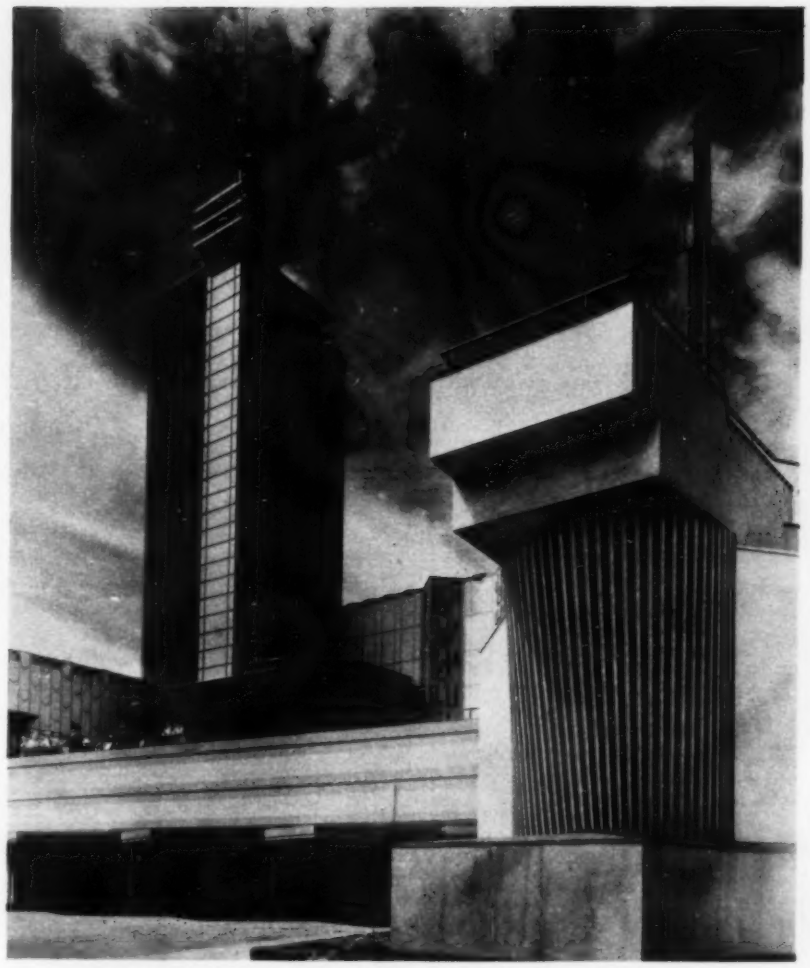
The Travel and Transport building, a great circular hall 100 to 125 ft. in clear height and 206 ft. in diameter, which adjoins the main building, is covered with the largest dome in the world. This dome is economically framed by being suspended at frequent intervals from cables extending above the dome and supported by twelve steel towers built in a circle around the structure. Speed of construction, economy in materials and clear exhibit space are the advantages which this structural innovation provided.

Three-hinged steel arches frame the roof over another large hall in this building, providing 80 ft. clear height over a space 100x240 ft. in area.

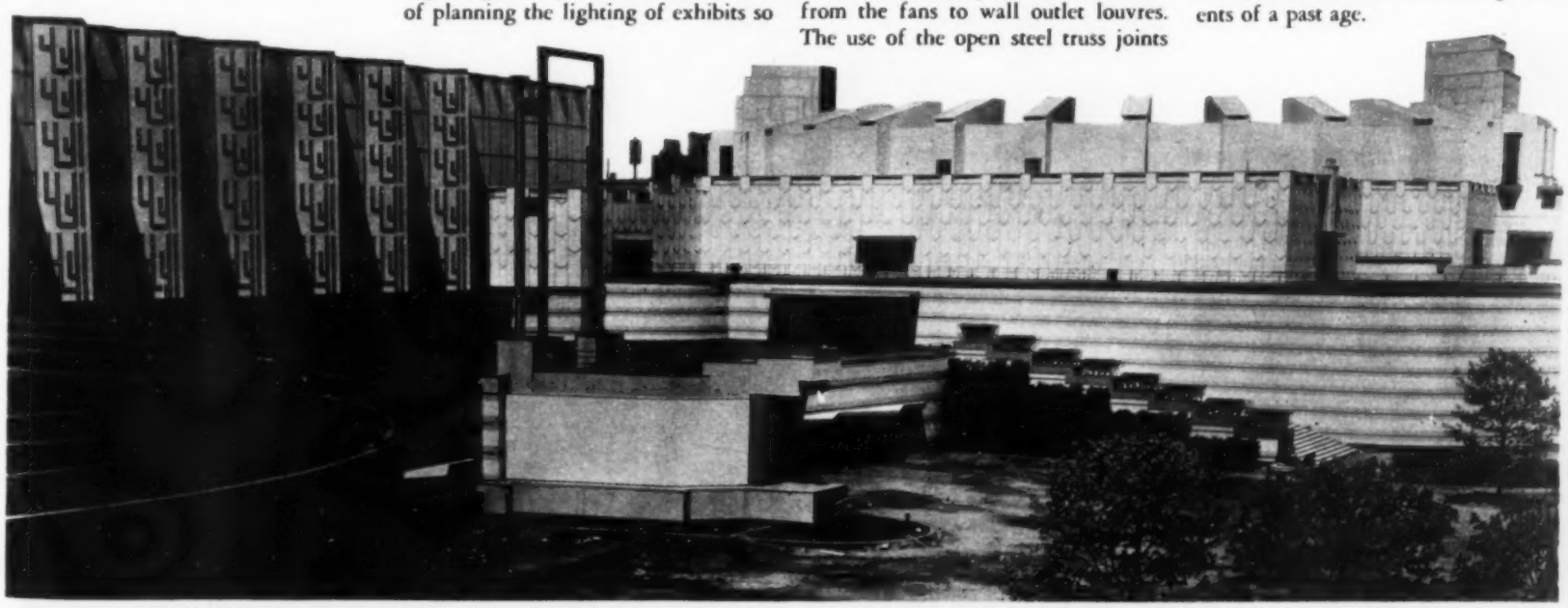
The United States Government building has a 65-ft. span ring dome over a clear space 71 ft. in height at the center. Outside of this dome are three triangular shaped towers 150 ft. in height.

Illumination has been made an important part of the architectural design of the Exposition buildings. For the elaborate use of exterior illumination of the buildings at night a wide variety of exterior lighting shelves, lighting panels, fountain effects and projecting fins concealing lighting sources are constructed.

Conclusions— The unusual developments described have been made possible by a daring use of new materials and new methods, based on sound experimentation and engineering principles. They have helped create for The Century of Progress Exposition a new and distinctive architecture which is fresh, alive and free from the precedents of a past age.



CARILLON TOWER 186 ft. high, equipped with 25 tubular bells and equipment for lighting at night, surmounts Hall of Science.



WALLBOARD SURFACES on Hall of Science and other exposition structures are given variety of decorative treatment with wood or metal battens.

9-YD. CARRY-ALL SCRAPER, equipped with dual pneumatic tires, is hauled by diesel powered Caterpillar tractor on highway contract of Myers & Goulton, of Seattle, Wash.

PNEUMATIC TIRES

Improve Operation of Heavy Grading Equipment

PNEUMATIC-TIRED earth-moving equipment is being used successfully by several Western contractors on highway and levee work. After several months of experience, rubber tires have been found to reduce tractor effort, permitting operation at the next higher speed, under equal conditions, as compared with the regular steel wheels. Further, the tires absorb shocks during loading and hauling, with resulting saving to the equipment. It is possible to move these scraper units on the highway at high speed on the rubber-tire mounting.

The innovation of pneumatic tires on the heavy 9-yd. carry-all scraper type of grading equipment illustrated was first tried on a highway contract in the desert region of southern California. The dead and lifeless character of the material under loading and hauling, with heavy draft on the tractors, resulted in the change in mounting as an experiment. The benefit was noted at once and proved a success. Since that time about 30 of these large scraper units have been put into use on Western grading projects and practically all of them are mounted on pneumatic tires. In fact, several contractors who originally did not wish to pay the additional cost for the tires, as against the standard steel-wheel equipment, later requested tires.

OPERATION OF SCRAPERS is by cable from tractor. Cable pulls rear gate forward to empty scraper. Coil spring pushes gate back into place after load is discharged.

On one grading job, a subcontract of H. W. McKinley under a state contract with C. G. Willis & Sons, Inc., Los Angeles, for a state highway contract near Santa Monica, Calif., two of the rubber-tired scrapers moved 25,000 yd. of decomposed rock and earth in 286 hr. on an average haul of 400 ft. The loads averaged 7.32 cu.yd., and the equipment was operated at 87.5 per cent capacity during the period at four 6-hr. shifts per day. A rooter was used on part of the work to loosen the material. The rooter was hauled by a Caterpillar "60" tractor which was also equipped with a bulldozer. Other equipment on the job included two 9-yd. scrapers each hauled by a Cletrac "80". On the scraper work, allowing a $4.75 per hour charge per unit, the material was moved at a cost of 5½c. per cubic yard.

On another California highway grading job Hemstreet & Bell, Marysville, handled 85,000 yd. of material on a 125,000-yd. contract with two of the 9-yd. rubber-tired scrapers. These two units moved an average of 90 cu.yd. per hour with a maximum of 120 yd. per hour on an average haul of 600 ft. The material varied from decom-

TANDEM HOOKUP. Tractor operator controls loading of rubber-tired scrapers by means of 4-drum power unit. One scraper only is loaded at a time. Loads are spread to required depth one after the other.

posed granite to solid rock and a rooter was used on practically all the work, in addition to some shooting. The cuts had a maximum depth of 30 ft. and the maximum fill was 60 ft. high. The loads averaged slightly more than 7 cu.yd., and the work was carried on through 5-hr. shifts per day.

The scraper consists of an all-welded silicon steel body 9x10 ft. in area and 4 ft. deep. It has a cutting blade 10 ft. long and a hauling capacity rated at 9 cu.yd., although when fully loaded it exceeds 11 cu.yd. Standard equipment includes steel wheels both front and rear with 24-in. face. The unit can be equipped with six 48x10-in. pneumatic tires, standard equipment for those units now in operation.

A recent development in this equipment is a double hook-up of two scrapers in tandem handled by the tractor operator with the aid of a four-drum power takeoff. The units are loaded in succession, and the outfit then moves to the point of fill where the scrapers are discharged to provide the required depth. This unit is hauled by a 70- or 80-hp. tractor.

TURN AROUND is made on 26-ft. road width. The 9-cu. yd. scraper is hauled by 60-hp. tractor.

In operation, the scrapers are loaded by lowering the cutting edge to the required depth and allowing the body to fill as the unit is pulled forward. The front gate, resembling a sector type of bin gate, receives and holds the forward-moving portion of the load as it boils up from the cutting edge and is finally closed when the load is complete. On arrival at the point of discharge the gate is opened and the rear end of the scraper is moved forward to discharge the load. This motion operates against a long coiled spring which is used to return the end gate when unloading has been completed.

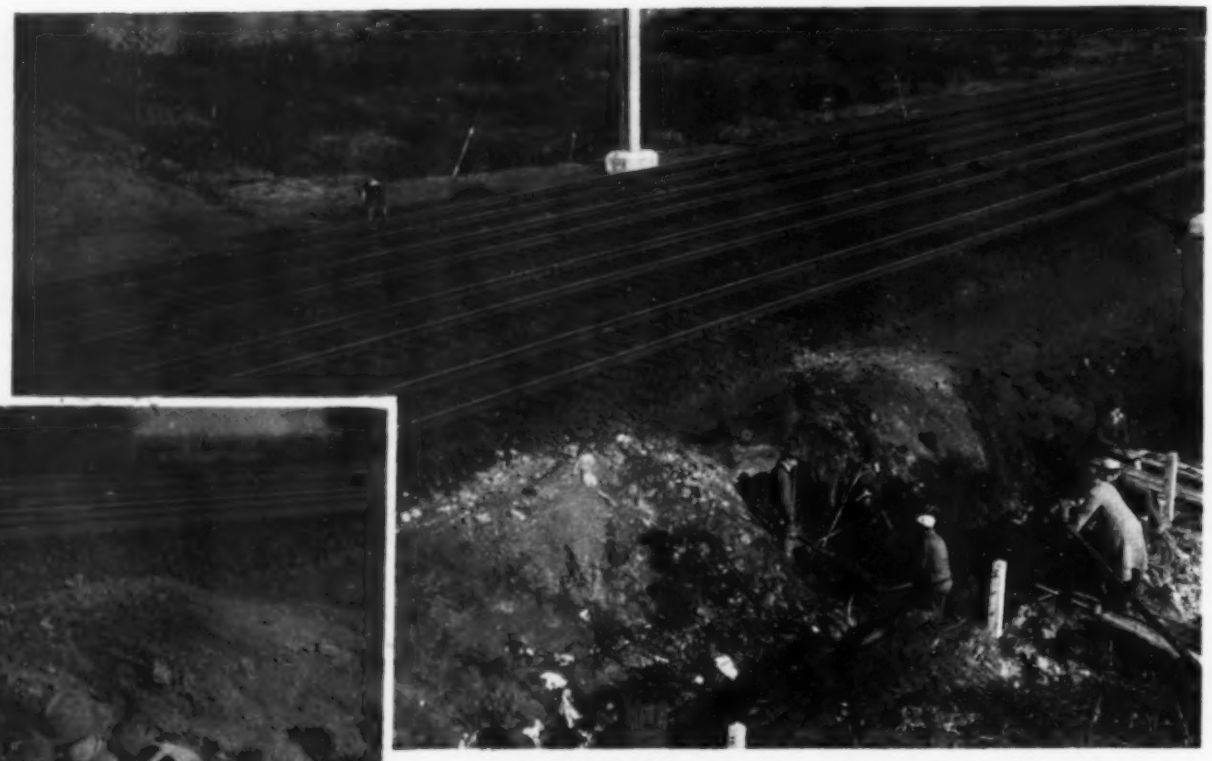
This equipment has been developed and manufactured by R. G. LeTourneau, Inc., Stockton, Calif.

DESERT SAND proves no obstacle to operation on dual 48x10-in. pneumatic tires. View shows front and rear details of 9-yd. carry-all scrapers.

HYDRAULIC BORING MACHINE

Installs Telephone Conduits Under Main-Line Tracks of Railroad

TO install conduits for telephone lines of the New Jersey Bell Telephone Co. under the main-line tracks of the Pennsylvania R.R. at eleven points, the Boring & Drilling Corp., of New York City, contractor, utilized a Hydrauger hydraulic boring machine to drill the holes for the steel-pipe conduit. By ordering the installations made in this way, without danger of disturbance to the tracks, the telephone company was permitted to place the work under contract, eliminating the delay and expense of the former method which involved costly trenching work by railroad section gangs. The boring machine drove the holes quickly and accurately through various materials and permitted rapid installation of the conduits without the hazard of any subsequent settlement.



77-FT. BORE is drilled under four main-line railroad tracks and 3-in. pipe conduit is installed in 6 working hours without disturbing tracks or slowing train operation.

AIR MOTOR mounted on carriage rotates hollow drill stem. Carriage, traveling on steel bedframe, is moved ahead by hand lever and ratchet mechanism, forcing drill bit forward in hole. One hose supplies air to motor, and second hose delivers water to drill stem.

Removal of telephone lines crossing the main-line tracks of the Pennsylvania R.R. was made imperative by the erection of high-tension transmission lines in connection with the electrification of the system between New York and Washington, D. C. A break in one of the high tension wires, causing it to fall upon an exposed telephone cable, would endanger the lives of workers on the telephone line and of operators in central stations and exchanges.

Bores made by the machine on this work were 5 in. in diameter and varied in length from about 60 to 110 ft. They penetrated sand and gravel, clay, shale, and conglomerate fill material. Boulders were encountered in several of the holes, but in no case were the stones large enough to stop the drill. The machine is capable of drilling holes in all types of cohesive soil and soft rock; it cannot penetrate hard rock for great distances or form an open bore in non-cohesive soils such as "sugar sand" or quicksand. Soils of suitable character for drilling were found at all the locations included in this contract.

Hydraulic Boring Machine—Essentially, the machine consists of a rotating, hollow drill stem carrying a continuous stream of water which lubri-

TO INSTALL ADDITIONAL SECTION in hollow drill stem, grip is applied to near end of preceding section at outer guide on bedframe, and head of boring machine is unscrewed from threaded pipe by running air motor in reverse.

cates and cools a bit at the forward end of the stem and flushes out the hole. An air-driven motor rotates the hollow stem, and a portable compressor is required to supply air to the motor. In addition to its other functions, the stream of water serves to mud the walls of the hole and to prevent sloughing. The drill stem is made up of sections, called boring bars, with threaded joints. Additional sections are screwed on to the drill stem as the boring progresses. Boring bars of the larger-size Hydrauger used for this work were 7 ft. long.

boring of holes for these installations has eliminated cutting and replacing of pavement and has supplanted older methods of tunneling, trenching, or jacking.

Preliminary Operations—As a first step in preparing to drive a bore for one of the telephone conduits, the contractor excavated a level space at the starting end by digging a pit or cutting into the side of the embankment, as required by conditions at the site. The steel frame of the boring machine, with or without the carriage, then was placed approximately in final position and

TRUCK-MOUNTED COMPRESSOR and 200-gal. water tank on trailer supply air and water under pressure to hydraulic boring machine.

AFTER DRILL BIT HAS BROKEN THROUGH into pit at far end of bore, wood plug is driven into hole to permit washing of bore with continuous stream of water as drill stem is withdrawn.

At the driving end of the drill stem an Ingersoll-Rand air motor is mounted on a carriage which is moved forward or back on a steel frame by a hand-operated lever-and-ratchet device. Before boring starts, the steel frame is staked down in fixed position and is brought to correct line and grade by means of screw adjustments. The carriage and its motor are demountable from the steel frame.

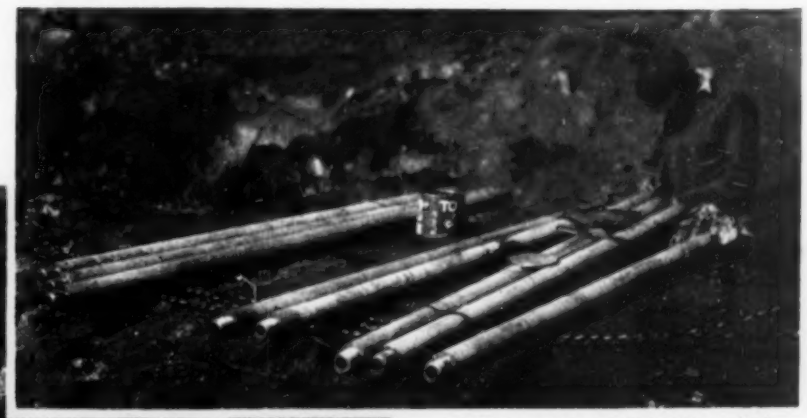
Two sizes of boring machines are manufactured. The smaller machine cuts a pilot hole 2½ in. in diameter, and this diameter may be increased up to a maximum of 4½ in. by inserting a reamer section in the drill stem. The bit of the larger-size machine used on the work described in these notes drills a 5-in. hole, which may be enlarged to any diameter up to 10½ in. by means of a reamer of proper size following the bit. As 5-in. holes only were required for the installation of the telephone conduits, it was unnecessary to use a reamer in making these bores. The steel frame and carriage-mounted motor of the larger machine weigh almost 500 lb., and this weight is about equally divided between the two parts. Thus the Hydrauger could be handled in two parts of about 250 lb. each by unscrewing a hand-operated screw.

In the last few years, the Hydrauger has been used extensively on public utility work to install pipes, conduits and sewers under pavement, as well as under railroad tracks. Hydraulic

was staked down with steel stakes at the four corners.

Demountable sights and a target furnished with each machine were used at most installations to align, or "aim", the machine by a simple operation similar to sighting a rifle. At several points, however, the sights could not be used because the height of the railroad embankment between the machine and the far end of the bore, where the target was set up, exceeded 5 ft. above the bottom of the pit on which the machine rested. In this case, the machine was lined up for direction parallel with a stretched cord and was adjusted to grade with the aid of a hand level.

DISMANTLED for hauling to next set-up. Carriage is quickly detached from frame. Each of two parts of machine weighs about 250 lb.



DRILL STEM SECTIONS, called boring bars, are 7 ft. long and weigh about 43 lb. each. They are made of extra heavy steel pipe with thread inserts sweated on and welded.

To start a bore, a 7-ft. boring bar, with the bit screwed into the fore end, was clamped at the outer drill-stem guide on the frame and was screwed up on the rotating head of the driving motor. After the carriage had advanced the full 7 ft. of its run, equal to the length of the boring bar, the outer guide grip again was applied, and the motor unscrewed the rotating head by running in reverse. A second boring bar then was inserted in the drill string and screwed up by the air motor. The grip at the forward guide bearing and the reversible feature of the motor greatly expedited the operation of inserting additional boring bars in the drill string. A grip at the rotating head of the motor was similarly useful in performing the reverse operation when removing the drill string from the completed bore.

Drilling Tools—Boring bars are made of extra-heavy fine-grade steel pipe with special thread inserts of heat-treated steel sweated on and welded. The threads of these inserts are capable of withstanding the severe shocks and

stresses incident to hard usage. The bit used with the boring machine is manufactured of cast steel with cutting edges of tungsten carbide, an alloy steel almost as hard as diamonds, set in Haschrome. One bit sufficed for eleven bores on this contract and drove several others in addition. The bit has a small orifice at the threaded end for the stream of water, which strikes the center of the spiraled cutting blade and divides into two parts.

Water is essential to successful operation of the boring machine in driving bores of any length. On the work along the Pennsylvania main line, the operator of the machine never moved the carriage forward after adding a fresh boring bar until he saw a stream of water issuing from the hole, assuring him that water was circulating properly through the bore. Pressure of water in the bit keeps the orifice clear of small stones and prevents clogging of the bit itself.

Water Supply—Ordinary water-main pressures of 30 lb. are sufficient for operation. It is possible in some places to take water from a nearby stream or pool with an air-driven centrifugal pump operated by the compressor. At the telephone conduit installations, however, no water supply of either kind was available. The telephone company, therefore, had made a welded tank of 200-gal. capacity and mounted it on a Highway trailer to be drawn by the compressor truck, which carried a Sullivan machine with a capacity of 110 cu. ft. per minute. This tank was filled with water from various sources by means of the pump at a rate of less than 5 min. per filling. When set up at the job, the compressor applied pressure of about 90 lb. per square inch to the water in the tank for delivery of a stream through a hose to the drill stem.

After the boring machine had drilled through to an excavated opening at the far end of a bore, the water supply

REMOVING BORING BAR from drill stem as bit is withdrawn from hole. Note that drill stem is full of water, indicating that stream is kept flowing into hole while drill is being pulled.

STEEL FRAME secured to ground with corner stakes can be adjusted vertically and transversely by screws at rear end. Ratchet moves carriage forward or backward on rack.

NEW BORING BAR is added to drill stem by first screwing new section to rotating head of machine and then screwing to preceding section.

was shut off, and the carriage was moved back on the frame to pull the bit into the hole. The far end of the bore then could be closed by a wooden plug driven hard into the hole. As the drill stem was withdrawn and boring bars were removed, the machine was kept revolving and a continuous stream of water was forced into the hole to wash out earth dislodged by the bit. This careful flushing process left a clean bore with no loose earth to accumulate in front of a pipe conduit and retard its installation.

Installing Conduit—Conduits at the eleven installations in this contract were 3-in. extra heavy galvanized steel coupled pipe with an outside diameter at the couplings of 4¼ in., leaving a small clearance in the 5-in. bore. For handling in narrow quarters, the conduit was made up in 10-ft. lengths. The work of pushing the pipe into the bore was performed mainly by hand, although installations requiring more than five lengths, or 50 ft., usually were completed by shoving the additional distance with the machine lever-and-ratchet device.

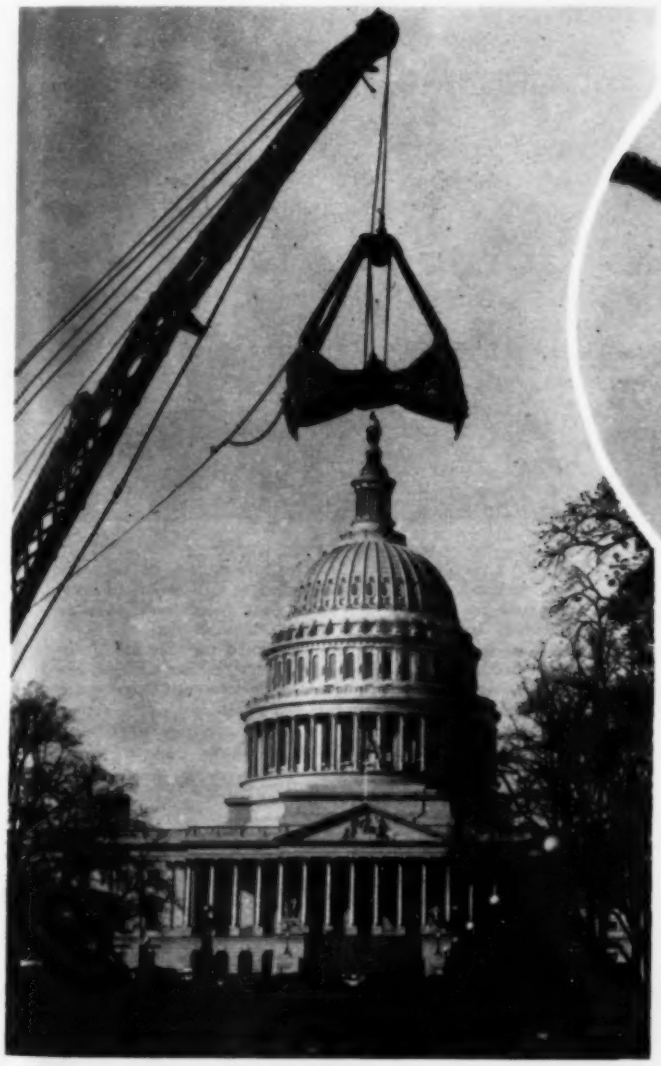
Progress—Rate of drilling at the various bores depended principally upon the material encountered. On its first day of operation, the machine drilled a 65-ft. hole through shale, and the contractor installed the conduit on the same day. At the longest bore, 110 ft., the machine completed the drilling in 80 min. A good cohesive soil containing some gravel and a little clay was found at this point. Thorough cleaning of the bores made it possible to install up to 80 ft. of conduit in 1 hr. On the day when a representative of *Construction Methods* inspected the work, the boring machine was set up, a 77-ft. bore was completed, and the conduit was installed between 8 a. m. and 3 p. m.

JOB ODDITIES

A Monthly Page of Unusual Features of Construction

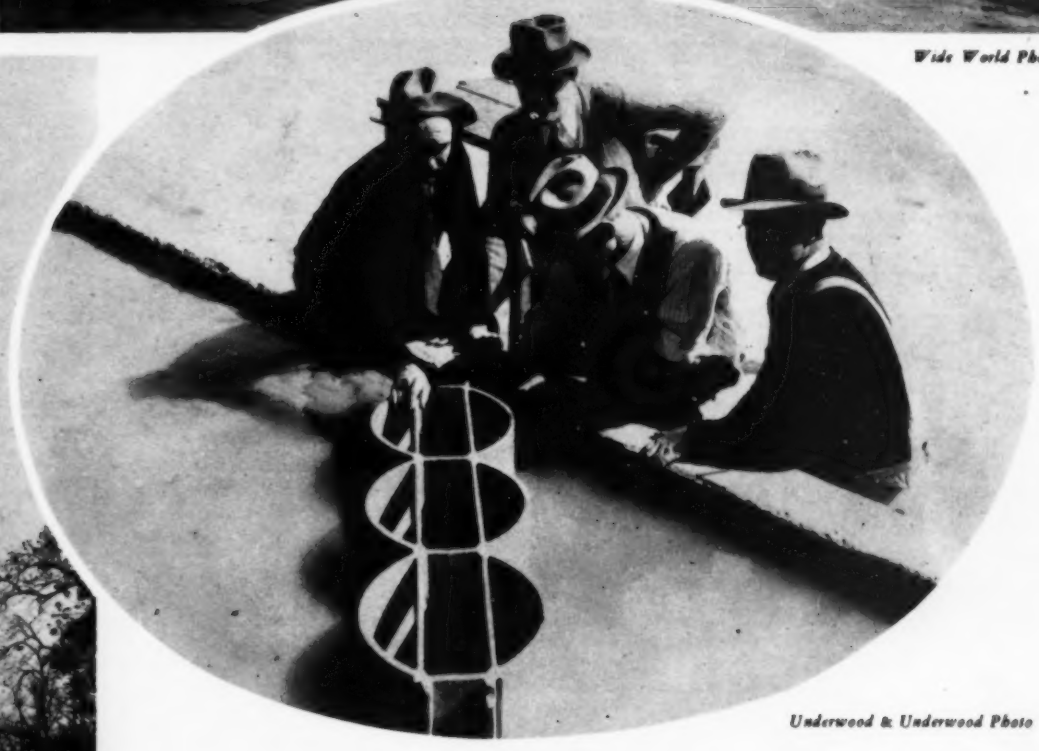
GEOMETRIC TRACERY *(right)* of intricate pattern is produced by the heavy structural steel members of the Kill van Kull Bridge, connecting Port Richmond, Staten Island, one of the five boroughs of New York City, with Bayonne, N. J. Forty-foot roadway is carried by steel arch with record-breaking span of 1,675 ft. between abutment bearing points. American Bridge Co. built structure from designs of Port of New York Authority, O. H. Ammann, chief engineer.

Wide World Photo



TAKING A BITE out of the Capitol at Washington, D. C. Optical illusion of perspective shows clamshell bucket on crane boom apparently closing down on dome of structure housing Congress instead of attending to its job of installing a new water main on the Capitol grounds.

International Photo



Underwood & Underwood Photo

MODEL OF BREAKWATER of unusual cellular design is tested before full-size installation is made in harbor at Long Beach, Calif.

PONTOON FOR PEDESTRIANS *(right)*. Temporary floating bridge is constructed across Kiskiminetas River, at Vandergrift, Pa., during building of permanent state highway bridge. Each day 4,500 pedestrians use pontoon crossing.

CRACK CONTROL IN

Asphalt Surfacing in Washington, D. C., Reinforced by Welded Wire Mesh

TO preserve unbroken surfaces in the sheet-asphalt top courses of heavily traveled streets in Washington, D. C., the Highway Department of the District of Columbia has developed a thick concrete base incorporating frequent strongly doweled expansion and contraction joints and a reinforcement of welded wire fabric. Even on unstable subgrade involving transitions from soils of high bearing power to those of low value, this construction is believed capable of preventing any serious disturbance or cracking of the sheet asphalt surface. A notable feature of the base design is a monolithic white concrete header cast flush with the final grade of the asphalt surface along the center line of certain streets to serve as a permanent traffic marker.

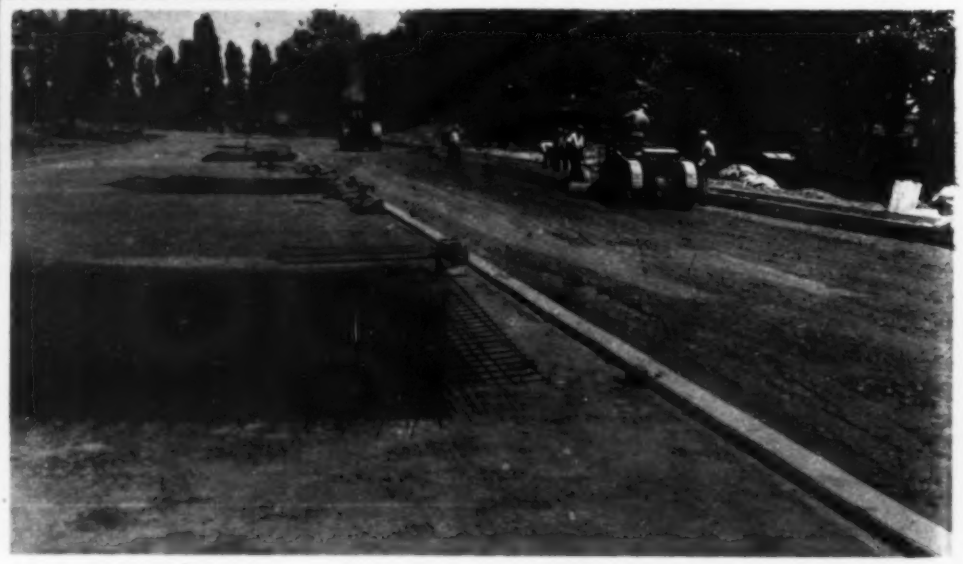
Concrete bases have been constructed in half widths, usually of 30 ft., to minimize obstruction of traffic. The

40-FT. WIDTH on north side of Pennsylvania Ave., leading to Capitol, is paved with 9-in. monolithic concrete base by two paving mixers working in parallel. Base concrete is cured with wet burlap. Use of high-early-strength cement permits placing of asphalt surface after 36 hr.

TWO PAVING CREWS *(right)* working side by side function as unit in laying 40-ft. width of concrete base in one operation. Welded wire mesh weighing 50 lb. per 100 sq. ft. is installed in slab by strike-off method to control cracks which might affect asphalt surface.

TEMPORARY BULKHEAD installed transversely across subgrade carries one end of steel plow-handle tamper strike-off which finishes base to true crown. Other end of strike-off rests on previously finished concrete. This method of finishing concrete bases has been adopted as standard by District of Columbia.

WHITE CONCRETE HEADER *(below)* 2½ in. high by 6 in. wide along outside edge of first half-width of concrete base on 14th St. will form permanent traffic marker on center line of completed 60-ft. asphalt surface. Two halves of base are divided by deformed metal plate along center line. Base contains transverse metal air cushion expansion joints at 40-ft. intervals with deformed metal plate contraction joints midway between expansion joints, separating base into 20x30-ft. slabs which are reinforced with 58-lb. welded wire fabric.



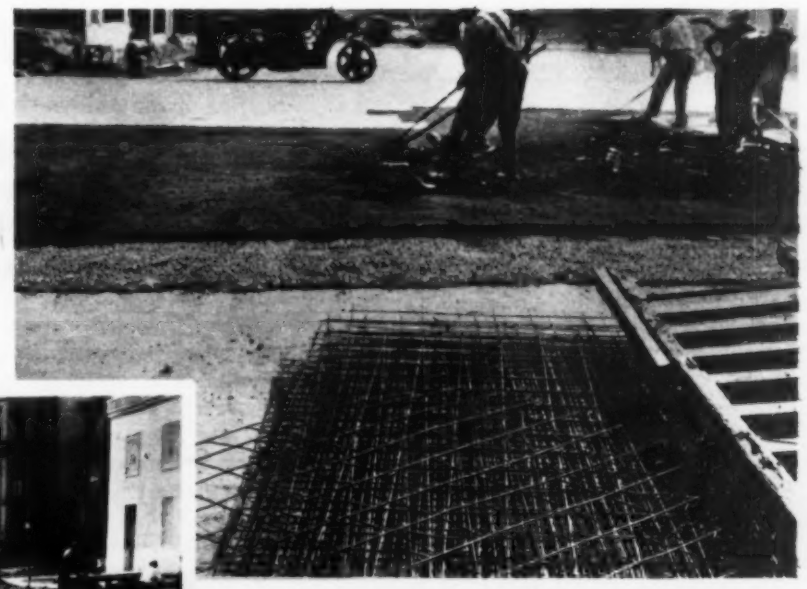
WIDE PAVEMENT

Is Laid on Concrete Base

and Divided by Expansion Joints

Highway Engineering & Construction Co., of Washington, speeded the laying of base on one contract by operating two 27-E paving mixers in parallel, thus reducing the time during which each half of a street was out of service. At intersections, high-early-strength cement was used to permit surfacing with asphalt in 36 hr. Work at these points was performed during the middle of the week to avoid interference with week-end traffic. The intersections were closed after the rush-hour traffic had passed and were opened again in 2 to 3 days. Concrete base between intersections was cured with wet burlap for 72 hr.; at the intersections this period was reduced to 36 hr.

The pavement was designed and constructed under the direction of Capt. H. C. Whitehurst, director of highways; L. P. Robertson, street engineer; and H. F. Clemmer, engineer of tests and materials.



SURFACE CONSTRUCTION. Sheet-asphalt top is being spread on binder course laid on concrete base. In foreground on concrete base is pile of welded wire fabric used to reinforce slab.

STAGES OF PAVEMENT CONSTRUCTION. Separated by white concrete header are concrete base covered with burlap at left and asphaltic binder course at right. In background trucks and rollers are spreading and compacting sheet-asphalt surface.

PERMANENT WHITE CONCRETE TRAFFIC STRIPE is cast monolithically with first half of base on 14th St. Special white cement used for surface of this header provides visibility. Top of header is set about 1/8 in. below grade of sheet-asphalt surface to allow for compaction of asphalt under traffic.

NEW PENNSYLVANIA AVE. PAVEMENT is opened to traffic while paving of Constitution Ave., intersecting at sharp angle, goes forward at left. Base design calling for closely spaced joints incorporating numerous dowels and for wire fabric reinforcement provides rigid support for sheet-asphalt surface even over transition points in subgrade.

Helps to Successful Contracting

IX... Progress Schedules

Ninth of a series of articles on applying business principles to construction and making profits by avoiding costly mistakes

By HARRY O. LOCHER
Contractor, New York

"HOW are you getting along," a carefree contractor on a big irrigation canal job in a western state asked.

"I'm whittling away at it," he replied. "So much out today, so much out tomorrow. Just give me time and I'll have it all in the dump by and by."

But the time was not given him. Progress that satisfied him did not satisfy the District. After several sharp warnings about his lack of progress, none of which had any effect, the District took over his section and completed it. Here was an easy-going contractor, lacking in certain directions, but particularly in a progress schedule showing a vivid picture of his job as it should have appeared from month to month if he was to complete it on time. Had he seen, day by day, his red line of actual progress getting farther and farther behind his black line of scheduled progress it would have been a grim reminder to him that he had to get a move on and speed things up, or he was sunk.

Charts—Fig. 1 represents the simplest form of progress chart. It needs little explanation. Items of work appear vertically on the left side of the sheet. Time, in days, weeks or months is plotted horizontally. The solid black line is the anticipated progress of each item of work and the red or dotted line the actual progress made. Quantities can be added for each month, both for the current month and cumulative, though some prefer to keep a separate graph for this.

"No sensible man would trust a cargo of goods to a sea captain who expected to start the voyage without charts, or who did not expect to check his position daily to discover where he was."

Now, if our "whittling away" contractor had made such a schedule at the beginning of his work and had seen his actual progress line falling away behind his necessary progress line, the chances are that he would have done something about it before it was too late. The vivid picture would have been there before him each day. Every time he looked at it he would have been reminded that he must speed up or things would be speeded up for him and at his expense.

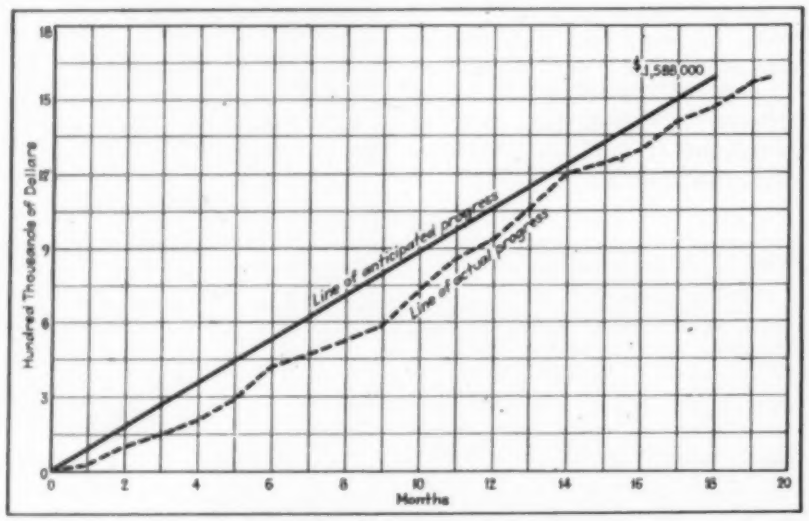


Fig. 2—MASS PROGRESS DIAGRAM gives comparison of actual and anticipated money value of work done every month.

Fig. 2 represents a mass progress diagram. The amount in money appears at the lefthand side; time appears along the bottom of the sheet. The black diagonal line running from the lower lefthand corner towards the upper righthand corner is the anticipated line of progress in money earned. The red dotted line moving in the same direction as the black one, its movement, however, being irregular as it varies from the straight black line of anticipated earnings, represents the actual amount of work done in dollars. No sensible man would trust a cargo of goods to a sea captain who expected to start the voyage, even over a familiar course, without charts, or who did not expect to check his position daily to discover where he was and how far he was from his destination.

A contractor starting a job is in the same position, almost, as the navigator. He has a definite objective—the completion of the job within the time allowed. Between the starting and the finishing of his work he should know his position at all times on all items.

The job progress schedule, properly prepared and kept up to date, is a barometer that tells the contractor whether or not he may expect fair weather, squalls or violent storms. It serves a vital purpose at the home office as well as in the field. "Get me Covington on long distance right away," an old timer said one morning, after looking at a weekly progress schedule which had come in from a job 400 mi. away. "Covington, I notice your drilling and blasting is getting considerably ahead of your excavation. Slack off and clean up your shots each time before shooting again. Yes, I know it's fine weather and you'd like to get a lot of it drilled and broken up. I tried that once. Drilled and shot 1,200 ft. ahead of the shovel, and had half of it to do over again, and at more cost than the first time over. Rock was all cracked up and harder to drill. Shovel racked itself to pieces too. And we kept losing toe after every shot. In some rock you can drill and blast ahead and come out all right, but not in that cut. Clean up after every shot, and get the toe."

Relation to Costs—These programs should be prepared, first, along with the bid. Progress schedules have a direct relation to costs. As you drop behind what you planned to do, your costs almost always go up. The schedule prepared along with the bid can be revised and modified in the event of being low bidder, facilitating the carrying on of the job and still closer relating progress and costs. Sometimes it happens that costs on some items can be lowered by speeding up the progress over originally planned schedules. It's a fine thing to have constantly before you the stimulus of knowing that unless you do a certain amount of work each day or week or month your costs will exceed your estimate and will exceed it more and more as your planned progress drops behind.

While it is an elemental fact that costs are largely based on the time element, when costs begin to get out of hand about everything else is considered before the time element, and right there is where the big leak may be. Some contractors, no doubt, will say that a progress schedule is no more than a plan on a piece of paper. Any construction man with gumption, they say, knows when he's dropping behind and when his costs are running up. You might say the same thing of a railroad schedule—it's nothing but a plan on a piece of paper. But if that plan is ignored, disaster quickly occurs. Contractors watch their costs and estimates with constant vigilance, but too few of them give the same keen attention to rigidly maintained progress, or realize the vital relationship between a hewn-to-the-line progress and originally estimated costs. You cannot separate them without courting losses.

"The progress schedule, properly prepared and kept up to date, is a barometer that tells the contractor whether or not he may expect fair weather, squalls or violent storms."

Many jobs are started without a plan of progress necessary to complete certain items on time and permit the work to come along in logical and economic sequence.

Clearing is "just started" excavation, steel erection, concrete. It's true some thought has been given to this starting, and most of the time it is understood that there is some relation between progress and costs. But unless there is a clean-cut, precise, vivid picture in a progress schedule, and unless it is fixed in your mind that as you fall away from this planned program your expected profits fall away, there's sure to be trouble ahead. This "some thought"

which you gave to progress and its relation to costs usually evaporates into thin air and on some frosty morning you will discover yourself "whittling away" on items which should have been finished long ago—and winter and a freeze-up just around the corner. How many, many times has the lament been heard, as fall breaks up on a job and frosty mornings and snow flurries give grim warning that winter and a shutdown, or slower progress and higher costs, are upon you. "We should have hit this or that item harder. Things will tighten up soon and we're stuck. Have to pull in here again in the spring for a little handful of work. That long stretch of good weather fooled us. Seemed as though we had all the time in the world", and on and on.

"Progress schedules have a direct relation to costs. As you drop behind what you planned to do, your costs almost always go up."

Danger Signals — Danger signals must be set up and rigidly observed. If the line of necessary progress shows that certain grading or concrete must be completed by, say, Nov. 1, at which time you know positively you will either have to shut down or carry on with costs greatly increased and with all hope of profits gone, your progress chart should show so much of this work to be accomplished each month or you should know the reason why. If your line of necessary progress keeps falling behind, it's only a question of time until crews and equipment will be "swarmed" all over a job in a feverish attempt to get this or that item caught up or completed before old man winter arrives, all as a result of failure to make and adhere to a vivid daily progress schedule. Often, one item of work is allowed to bump right up against another not yet started, but which should have been started and out of the way long ago. Then there is a feverish haste to get this delayed work under way, often with logical sequence disturbed, and often at a sacrifice of orderly methods and close economy. And another sometimes costly result from a lack of a rigidly followed progress schedule is that the costly results are cumulative. Each lagging item adversely affects an item to follow, and soon enough we find the "swarming" game about to begin.

A well kept and rigidly followed progress chart is a splendid incentive and stimulus for precise, orderly and economical operation. It can be seen from day to day just what is the status of each item of work; which ones are dropping behind and which ones getting ahead of schedule. With such a guide, forces can often be shifted from one place to another when, if there is no actual, accurate knowledge of the real status of all units of work, additional forces might be put on at an added cost at a time when there was no necessity for it, no real good accomplished, and the regular organization's work interfered with. The "picture" is there from day to day, something to shoot at, a plain target supposed to be hit. It keeps men dead in earnest and up on their toes.

When this daily picture shows portions of the work dropping behind, those responsible know that something is going wrong and it's up to them to discover what it is and make it right. Until they do that their job is sick, and a gnawing away at profits has begun. You may depend upon it that this grim finger pointed at you warningly, day after day, is going to hit you harder than just recalling every now and then, "Well, we are so many yards short of what we should have in. We've got to get a move on, or we are going to get caught." Usually, after each such rumination, there is a spurt of activity which soon spends itself. Things again begin to drag. Then, some cold morning winter hits, and you are either closed down or have to continue to operate with costs gone on a rampage.

A progress chart which you had lived up to would have meant that your work was done, and winter would have been welcomed rather than looked upon with dread. It's easy to drop behind when you do not have a fixed mark to shoot at, and it's equally easy to think you can catch up. Too many times you cannot. Unexpected things happen and you're stuck.

Sometimes, too, it may be a sign of danger when certain portions of work run ahead of the designated schedule. When they do, the situation should be carefully investigated and a conclusion reached as to whether or not such running ahead is justified by results, or whether it is likely to disturb the sequence of operations later on and increase costs. Some progress schedules are made so high that it is not possible to keep up the rate or sequence that they call for. In such cases interest in them is usually lost and they are neglected altogether, or they are not considered important and are kept in some sort of hit-and-miss way. Finally, after a constantly waning interest and a half-hearted attempt to live up to the schedule set, the plan is abandoned as useless and a worse scheme of no plan at all is adopted.

To avoid this situation, arrange progress schedules sensibly, taking into account everything that has a bearing on the work: the man in charge and his methods of operation; how the weather may affect progress; will materials be received when and as wanted (a progress schedule is a good reminder of when materials will be needed); might some portion of the work be done more advantageously by "subbing" it; if so, make arrangements with your subcontractors and fit them into your progress picture; if the job is large enough and the time allowed sufficient, may it not be better to ignore entirely some portions of the work in the first season's progress schedule?

Reasonable Schedules—Much of this seems elementary, but the point to be remembered is not to prepare a progress program impossible of accomplishment and then let it drop when you fail to meet it. Set progress marks that, while keeping the organization on its toes, can be attained by clear thinking and hard work and with no toleration of any let-down if the going gets a little tough, or if plans do not work out just as hoped for. Give the plans a little flexibility to compensate for unexpected happenings; there are always some, but do not make it too easy. Keep the target up and keep shooting at it.

"It's easy to drop behind when you do not have a fixed mark to shoot at, and it's equally easy to think you can catch up."

Originally worked out costs usually follow along in fairly close ratio to the progress which should be made, so when progress drops behind, up go the costs. There are some exceptions to this, but as a rule when you are not doing the amount of work you should be doing you are not doing it as economically as you should. Simply, a progress schedule is a picture of what you have to do and when you have to do it, what you have done and what yet remains to be done. It shows just how much time can be safely spent on every item and when this time should begin and end, so that items of work can follow one another in proper sequence to facilitate operation. It helps avoid repetitions and costly rehandlings. In keeping costs down, it tells in advance when a change of methods or additional equipment may become necessary.

A construction job is on comparatively safe ground when it is under the direction of a real superintendent; when it has a sensible but simple cost system that really shows costs before it is too late; and last, but far from least, when it operates under the eagle eye of a well planned, rigidly followed progress schedule. It is assumed, of course, that the bid prices are such that a profit can be got from them.

If thoughtfully prepared and within the realm of accomplishment and rigidly adhered to, there is perhaps no greater urge or stimulus to carry a job along with snap and precision- and expectation of profit- than common sense progress schedules. They would save many a job from going to the bottom, which was sinking a long time before it was known that leaks had been sprung.

●

NEXT MONTH: The tenth article in this series by Mr. Locher will discuss "Relations with Engineers."

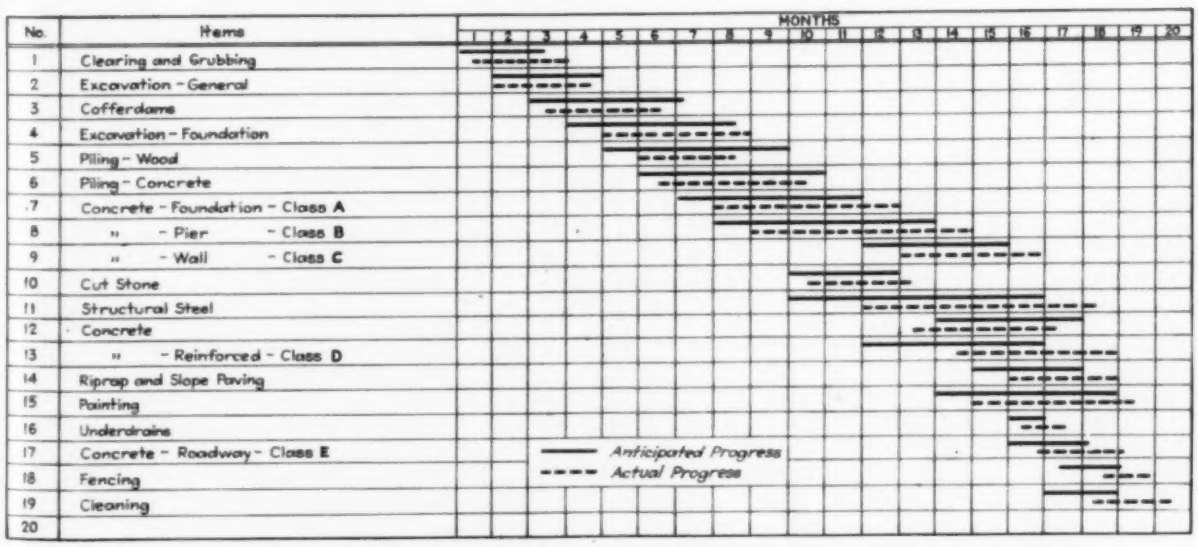
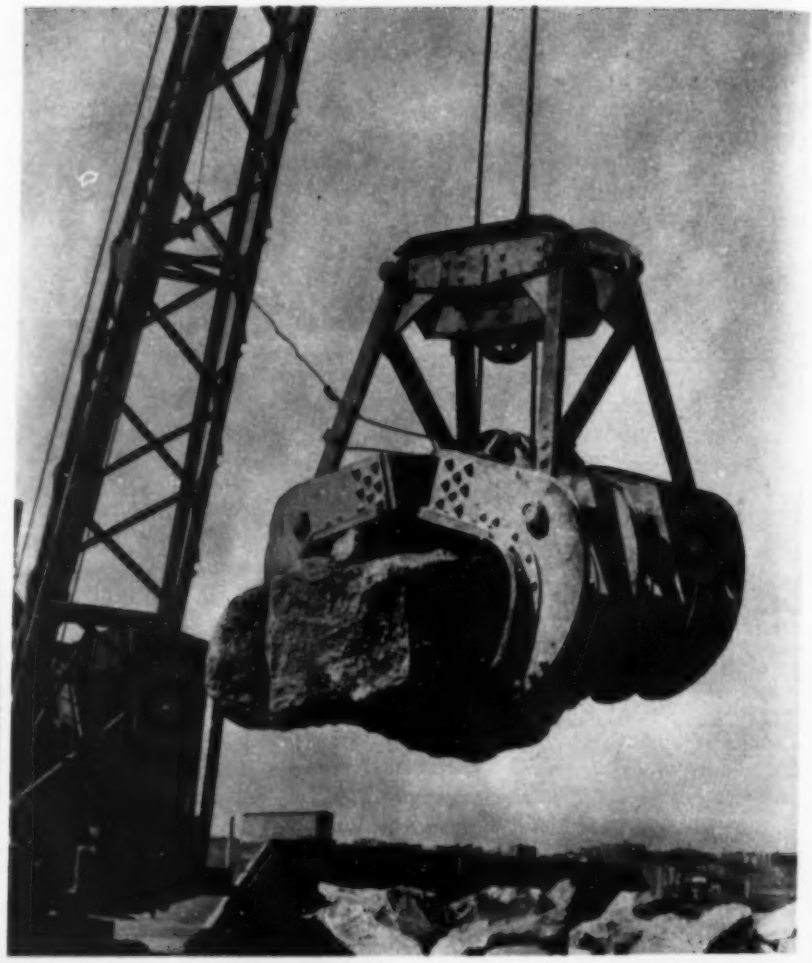
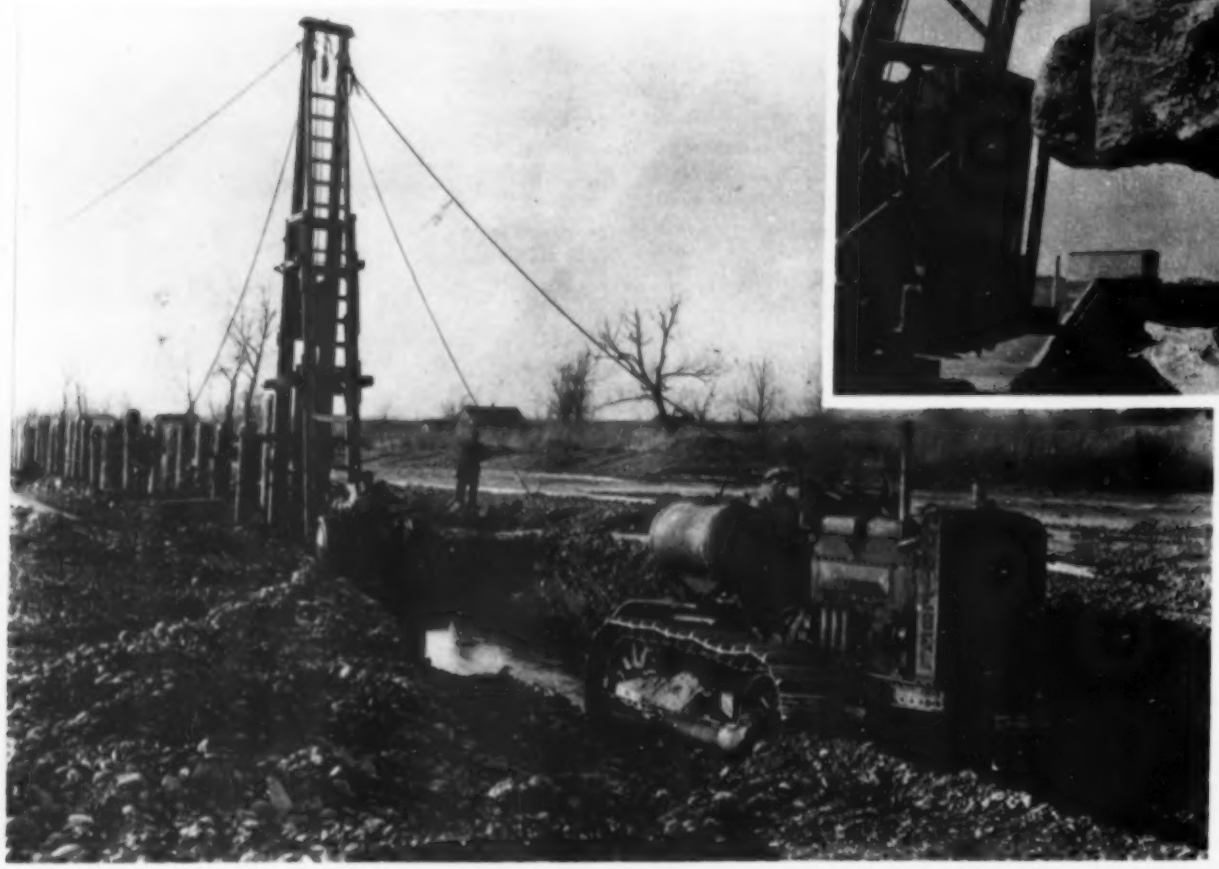


Fig. 1—ITEM PROGRESS DIAGRAM, in its simplest form, shows actual and scheduled time for beginning and completing various classes of work.

Getting Down to
DETAILS

Close-up Shots of Job Methods and Equipment

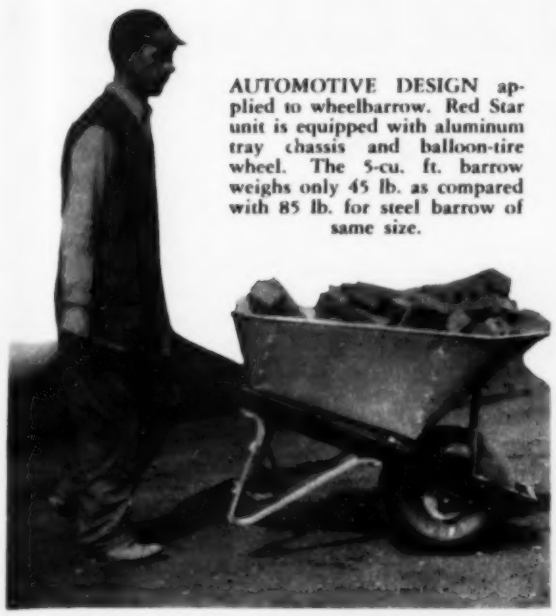




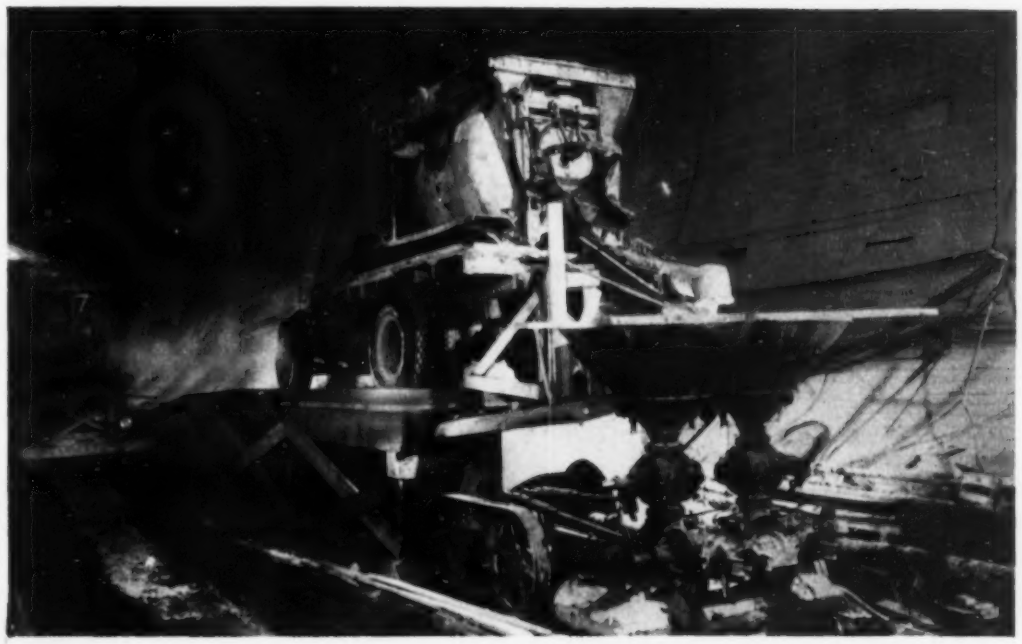
ROCK GRAPPLE *(above)* of special design proves useful for breakwater construction. Blaw-Knox heavy-duty unit, weighing 25,000 lb., unloads 400-ton rock barges in 1 hr. 40 min. for Clarence L. Smith, Inc., New York contractor. Size of load per grab, including cleanup, averaged 4 cu. yd. Grapple eliminates hazard of using chain slings.

TRACTOR-OPERATED PILE DRIVER *(left)* is used by City of Walla Walla, Wash., on work of preventing property damage by erosion of stream banks during flood stages. Machine pulled by diesel-powered Caterpillar unit drives line of wood piles to which planks are spiked and backfilled with rocks to confine flow.

AUXILIARY ROLLER WHEEL may be fitted on to light maintenance truck for compacting bituminous pavement patchwork, widening strips or shoulder repairs. Removable steel band, 17 in. wide and weighing 250 lb., fits over rear wheel of dual-pneumatic-tired truck and is held in place by a series of lugs between the pair of tires. With Lawrence auxiliary roller wheel, according to New England Metal Culvert Co., of Boston, compression of 240 lb. per square inch is produced with Ford or Chevrolet truck. Roller wheel does not affect riding qualities of truck at reasonable speed or interfere with ordinary maintenance uses of vehicle.

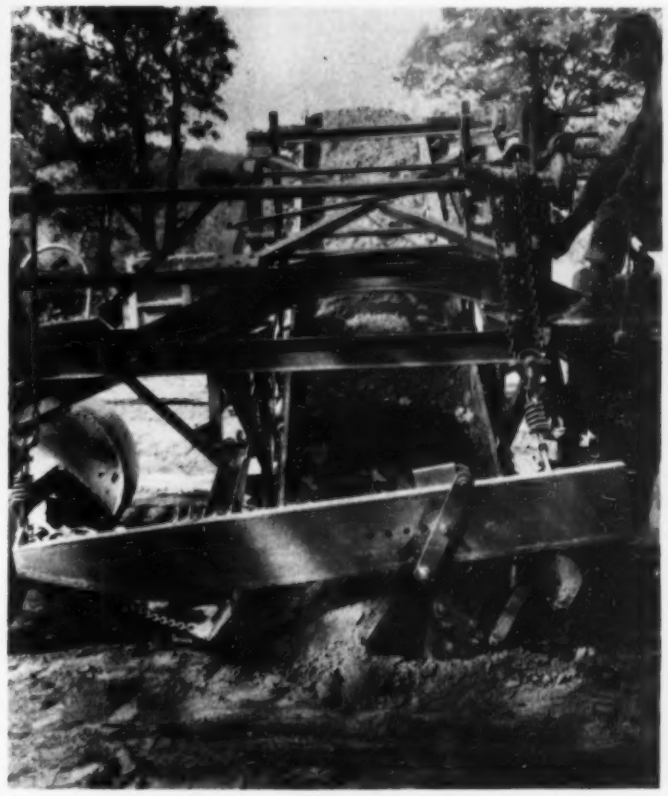


AUTOMOTIVE DESIGN applied to wheelbarrow. Red Star unit is equipped with aluminum tray chassis and balloon-tire wheel. The 5-cu. ft. barrow weighs only 45 lb. as compared with 85 lb. for steel barrow of same size.



PUMPED CONCRETE is used to fill plug sections in diversion tunnels at Boulder dam. Equipment developed by Chain Belt Co. works on principle of two-valve plunger pump, receiving concrete from hopper supplied by transit mixers and forcing it through pipe to place.

ON WIDENED CURVES of brick-paved highway in Tennessee, Soclay Paving Co. provides auxiliary track to carry template for leveling off cushion course on which vitrified brick is bedded. On tangent sections template rides on concrete curb integral with 5-in. base. At curves normal 18-ft. width is increased to 20 or 22 ft.



FREE FLOATING PLOW BEAM *(above)* on Caterpillar elevating grader of J. R. McLean, St. Croix County, Wis., prevents damage when plow disk strikes hidden obstructions. Plow beam is a built-up box section weighing 675 lb., suspended on chains to insure uniform furrow and easy, accurate adjustment.

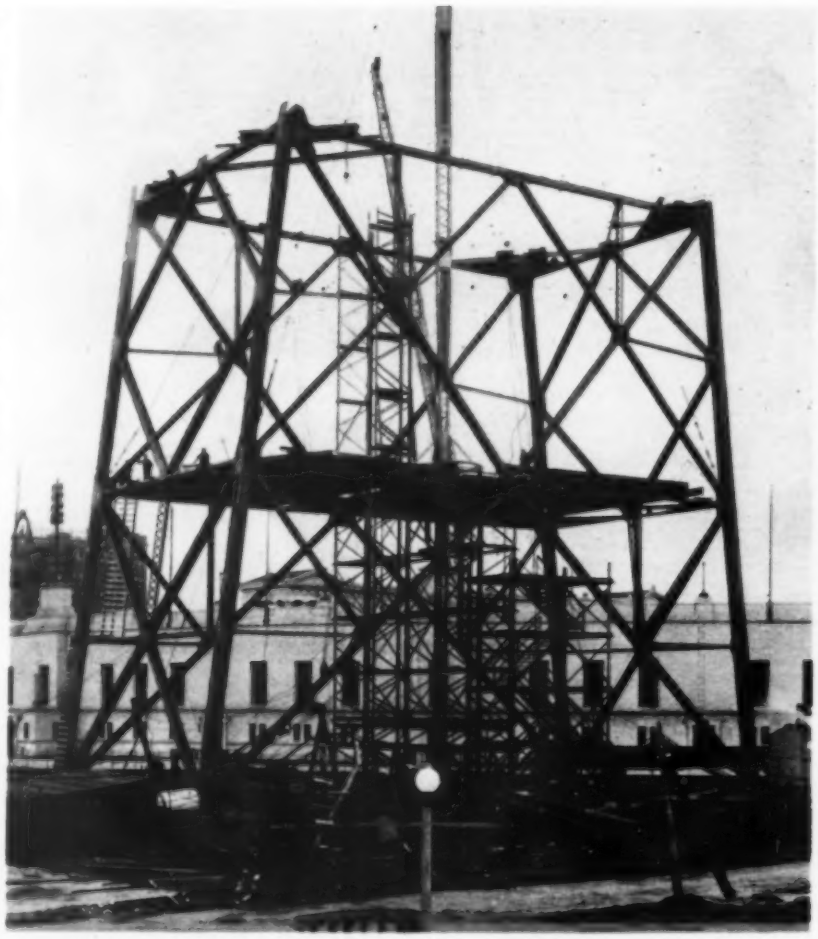
WIDE, OPEN-CUT APPROACH *(left)* to pedestrian and vehicular tunnels under Scheldt River at Antwerp, Belgium, is excavated with equipment of the trenching machine type having a capacity of 1,700 cu. yd. per 8-hr. shift and equipped with an endless chain of buckets delivering material to cars on track paralleling the trench. For the contracting firm of Pieux Franki, Liege, Belgium, Parsons Klapp, Brinckerhoff & Douglas, of New York, acted as consultants.

World's Fair Aerial Cars Travel on Cables From

SKYWAY TOWERS

A TRANSPORTER suspension bridge combining the features of a cable suspension system and a heavy-duty rope tramway is giving visitors to Chicago's Century of Progress Exposition, opened to the public this month, thrills equal to those of an older generation that rode on the Ferris wheel at the first World's Fair in 1893. "Rocket" cars similar in outward appearance to the control cars of airships travel along this so-called Skyway in a horizontal plane 200 ft. above Lake Michigan on track ropes suspended between two 600-ft. steel towers spaced 1,850 ft. apart. Although transporter suspension bridges are not new in principle (structures of this general type having been utilized previously to some extent in this country and to a much greater extent in Europe), the 1,850-ft. span of the Skyway at Chicago is the longest that ever has been attempted, and the designers introduced a number of innovations in the interests of economy and simplicity.

An entirely new suspension system, for example, was devised to eliminate the expense of the conventional stiffening truss by supporting the track cables in as nearly a horizontal plane as practicable. As indicated by the accompanying sketch of the transporter bridge, the suspension system may be regarded as a triangular truss, with all the cable members in tension, suspended at a number of panel points by diagonal ropes from the tops of the towers. The track ropes form the bottom chord of the triangular truss. At no point is the cable system fixed or dead-ended to the towers. An ingenious arrangement of vertical links, to which the upper and lower cables of the suspension system are attached at the towers, transmits all horizontal reactions except wind loads to the backstay cables. Backstays from the upper cables are secured to gravity-type anchorages about 600 ft. back of the towers, and backstays from the lower cables are attached to pivoted counterweights which are pin-connected to the gravity anchorages. The pivoted counterweights serve to keep a uniform tension in the track ropes.



FIRST TWO SECTIONS of west tower are erected by guy derrick near Soldiers Field stadium. Tower measures 50x110 ft. in plan at base. Towers are braced in horizontal planes not more than 50 ft. apart, with intermediate panel points at intervals of about 25 ft. Derrick rests on elevator shaft steel.

Origin of Skyway—The success of W. C. Hamilton, of Scotland, who had built a number of transporter suspension bridges in Great Britain, persuaded the Century of Progress Exposition to embark upon a similar project. After consultation with exposition officials, five firms, all well equipped in experience and plant to undertake the work, agreed to cooperate in erecting and operating the Skyway. The five firms and the parts of the project which they agreed to undertake were: Great Lakes Dredge & Dock Co., foundations; Inland Steel Co., furnishing structural steel; Mississippi Valley Structural Steel Co., fabricating and erecting structural steel; John A. Roebling's Sons Co., furnishing and erecting cable suspension system and tramway cars; and Otis Elevator Co., furnishing and installing tower elevators.

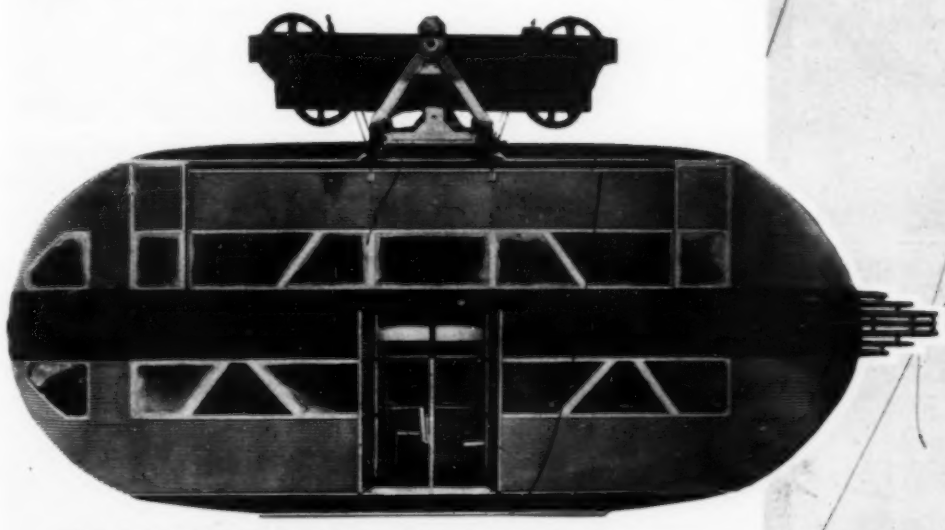
Robinson & Steinman, consulting

TRANSPORTER SUSPENSION BRIDGE with 1,850-ft. span crossing lagoon and exposition buildings carries rocket cars at speed of 520 ft. per minute on horizontal rope tramway more than 200 ft. above ground. High-speed elevators serve inclosed observation platforms in towers at 592-ft. level from which stairs rise to open observatory at El. 605.

bridge engineers, of New York City, were selected to design the structure, and Joshua D'Esposito, of Chicago, was appointed chief engineer, with I. F. Stern as associate. N. A. Owings, development supervisor, was in general charge of the project for the Exposition.

Tramway System—Each of ten duralumin, double-deck tramway cars with which the system is equipped has a capacity of 36 passengers. Each car is hung by a single center trunnion from four two-wheel trucks running on four track ropes.

Between the towers, the cars are drawn forward at a speed of 520 ft. per minute by continuous traction ropes. The tramway system is divided into two distinct units, one on each side of the towers, with an independent traction rope to serve for travel in each direction. The cars are attached to the traction ropes by grips which are locked and released automatically as the cars leave and approach the towers. At the towers themselves, the cars travel from one side around the back of the structure to the other side on rigid rails. During this part of the trip the cars are propelled by electric motors mounted on the inside wheel trucks.



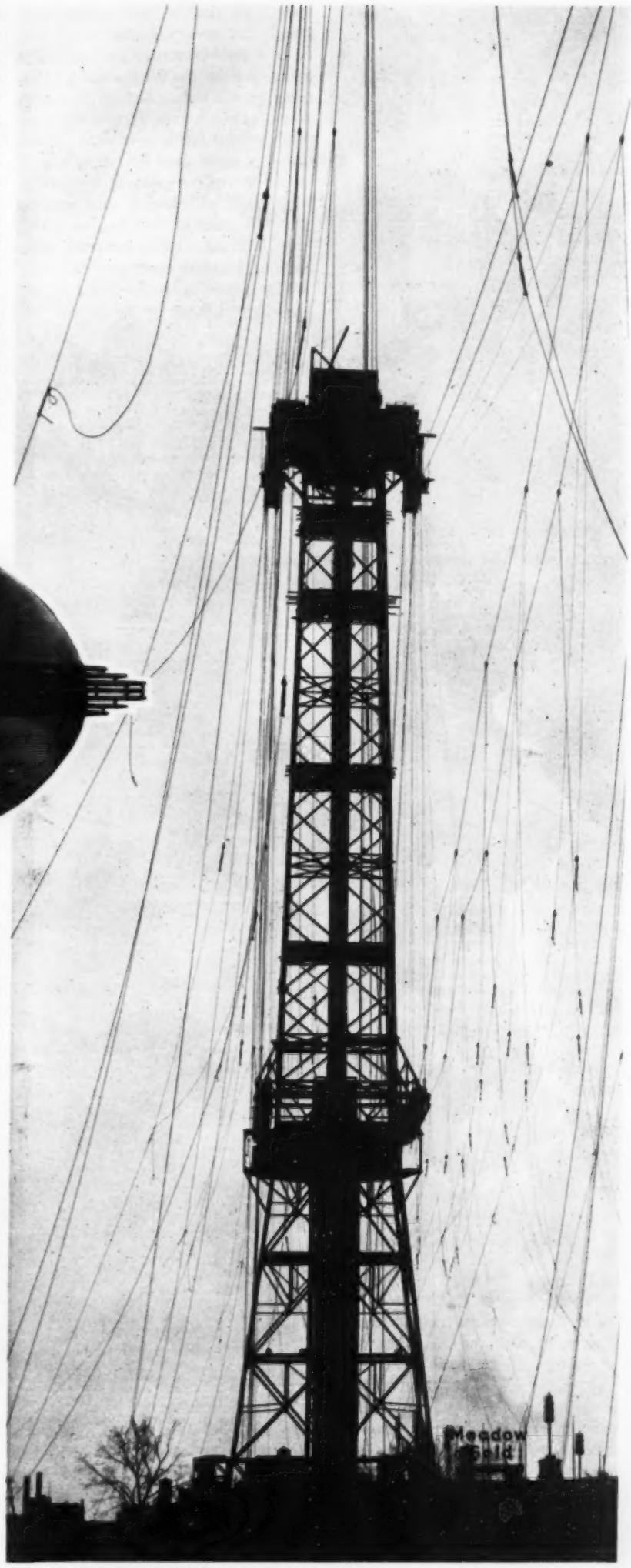
DURALUMIN DOUBLE-DECK ROCKET CAR carrying 36 passengers is suspended by single center trunnion from four two-wheel trucks, each of which rides on separate track rope.

To provide a flexible connecting link between the track ropes and the rigid rails around the tower, the designers introduced suspended trusses, projecting about 70 ft. from the face of the tower, pin-connected at the tower ends to hanging girders which are suspended by vertical links from tower brackets. The hanging girders serve also to transmit the horizontal reactions of the lower cables to the backstays.

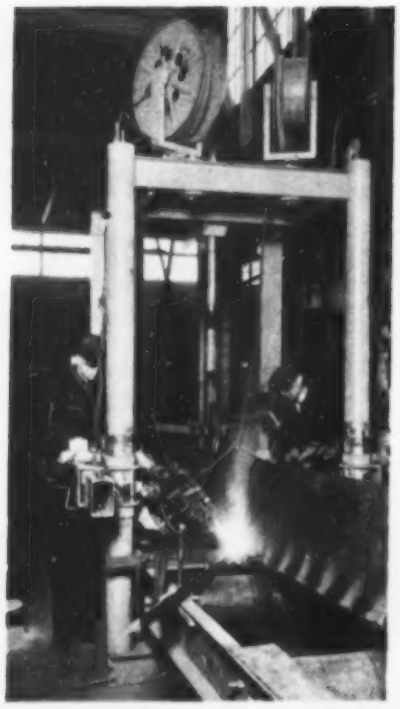
Suspension System—The suspension system was designed to reduce to a minimum the deflection at any panel point caused by passage of a loaded car. Each pair of track ropes is supported by an independent suspension system, making four suspension systems in all, two for the eastbound track and two for the westbound. The tracks are 75 ft. apart, c. to c. As shown by the accompanying sketch, each suspension system consists of two main cables and a number of auxiliary cables extending from vertical links at the tops of the towers to a triangular rope truss. Diagonal tension ropes from the upper chord of the truss support the track ropes which form the lower chord. The cables were prestressed to working tension and cut to exact length at the factory.

Practically all the cables were made discontinuous at intersection points and terminals. The four cable systems of the transporter suspension bridge required a total of 328 separate cables cut to 38 different lengths. Each system supports two 1½-in. locked smooth-coil track cables. The main suspension cables from the tops of the towers to the center of the rope truss are two 1¼ in. round wire ropes. Other members of the suspension system between the towers are single cables, with the exception of two connecting links of the lower cables at each tower. Each backstay group from the top of a tower to a gravity anchorage consists of four 1⅜-in. round wire ropes; the backstays from the lower cables to a counterweight are three 1⅜-in. ropes.

Steel Towers—Operation of high-speed elevators in the tall steel towers supporting the suspension system was an important factor affecting both the design and erection of the two structures. Exceptional accuracy was required in order to have the elevator shaft as nearly vertical as possible. The steel contractor guaranteed that the shaft would have no greater error from verticality than 1/1000 of the total height, that the maximum variation from a straight line between the top and the bottom would not exceed ¾ in., and that the dimensions at any cross-section would not vary more than ½ in. from plan dimensions. As a result of careful fabrication and erection, the completed towers actually were at no point more than ½ in. out of verticality. The towers were erected simultaneously by guy derricks which later raised the cables of the suspension system.

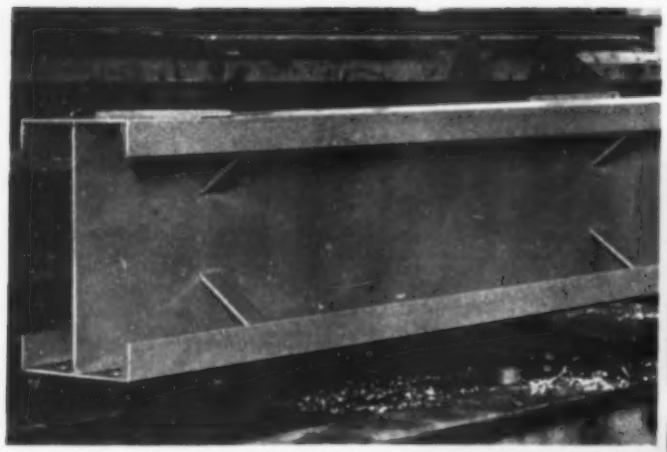


VAST NETWORK OF CABLES hangs between two 600-ft. towers, as erectors raise four suspension systems made up of 328 separate cables. Upper cable systems are attached at tower to suspended vertical links and lower systems to hanging girders which transmit horizontal reactions to backstays.

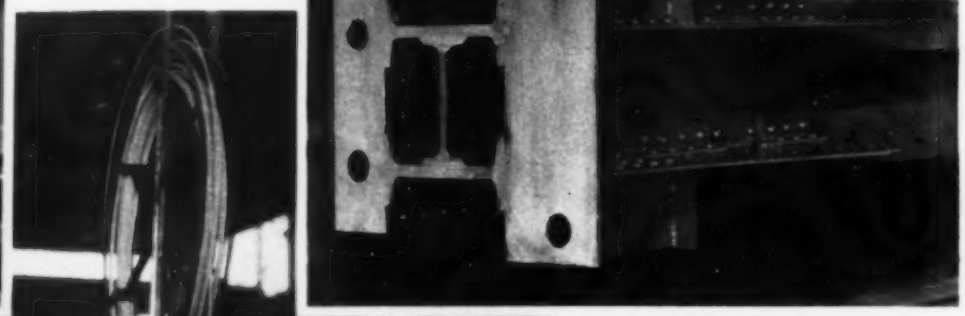


AUTOMATIC MACHINE *(left)* welds web plate and channel flange member in first operation of fabricating built-up bracing strut for tower. Machine moves material in front of welding heads and keeps it in line with guide rollers. Welding speed is 5 to 6 in. per minute; skipping speed, 40 ft. per minute.

ELEVATOR SHAFTS *(right)* and emergency stairway to 218-ft. ride level are inclosed with insulated metal sheathing. Tail tower at anchorage side of main tower supports transfer platform of tramway system. Suspended rigid rails carry rocket cars around rear of tower. Projecting cantilevered girders will carry transfer carriages used to remove cars from service.



WELDED TOWER BRACING STRUT made up of web plate and two channel flanges is reinforced with welded plate stiffeners at third points (not shown here) and intermediate diagonal bars welded to web and flanges.



BASE OF LOWER COLUMN SECTION employs both welded and riveted details. Tower columns are of constant dimensions, being fabricated of one 15-in. I-beam web and two 20-in. I-beam flanges, but vary in weights of members. Lower section has 95-lb. web and 150-lb. flanges.

AFTER ASSEMBLY AND TACK-WELDING at 10-ft. intervals, members of tower column section are placed in cradle, and fillet welds are deposited continuously by welding carriage.

struts. As one of the photographs shows, the tower columns were made up of three I-beams, two 20-in. beams being used for the flanges and a 15-in. beam as the web. Welded H-section struts for the towers were made up of two channels and a web plate. Fabrication of more than 500 struts and of 96 50-ft. column sections required about 19 mi. of automatic fillet welding and 3½ tons of welding electrode.

In addition to the automatic shop welding of these members, the tower design called for hand-welding of battledeck steel floors for the loading and unloading platforms at the ride level, for the transfer platform at the top of the tail, and for the two observatory floors. The battledeck floors were made up of standard floor plate sections 5 ft. wide by 20 ft. long.

Elevators—The high-rise elevators have car platforms 7x7 ft. in plan and travel at a speed of 700 ft. per minute; the two high-rise units in each tower can transport 900 passengers per hour in each direction between the observatory level and the ground. The low-rise cars, 7x8 ft. in area and operating at a speed of 500 ft. per minute, can take care of 1,700 passengers per hour to and from the tramway level of each tower.

Anchorages—Backstays from the upper cable system are secured to concrete gravity-type anchorages measuring 100 x12 ft. in plan by 12 ft. deep. These anchorages rest on foundations of timber piles 70 ft. long and are reinforced against horizontal reaction by a line of Inland inter-locking deep-arch-section steel sheetpiling 20 ft. along the tower face and the two ends of the anchorage.

Two wings extending back from the gravity anchorage support the counterweights to which the backstays from the lower cable system are attached. Specifications required that concrete in the counterweight bins should not vary more than 2 per cent from the calculated required load. All the ingredients of the concrete placed in the bins were accurately weighed before mixing. The top of the concrete in the bin is covered with waterproofing to prevent variation in weight due to rain and absorption.

Concrete in each of the gravity anchorages was placed in one continuous operation by the Great Lakes Dredge & Dock Co. Using two mixers at each site, the contractor completed the east anchorage in 14 hr. and the west anchorage in 11 hr.

Steel boxes for the pivoted counterweights were erected and riveted on wood blocking 3 ft. above final position. After they had been filled with concrete in this position, the backstay cables were attached, and the counterweight bins were lowered gradually by jacks until the full tension had been applied to the backstays, when the jacks and blocking were removed.

Each tower is served by four elevators, two to the 218-ft. ride level and two to the 592-ft. observatory level. Above the glass-inclosed observatory at the latter level, each tower carries an open air observatory at an elevation of 605 ft. The highest steel of the towers is at El. 628 and the top of the steel base slab is at El. 17.25.

Both towers stand on filled ground, and the concrete blocks carrying the tower legs rest on timber piles 65 to 70 ft. long. Similar foundations support the legs of the tail tower which reinforces each main tower at the rear and which carries the transfer platform of the tramway system. The four concrete piers under the main tower and the four under the tail tower are braced laterally by concrete struts which tie the foundations into a unit.

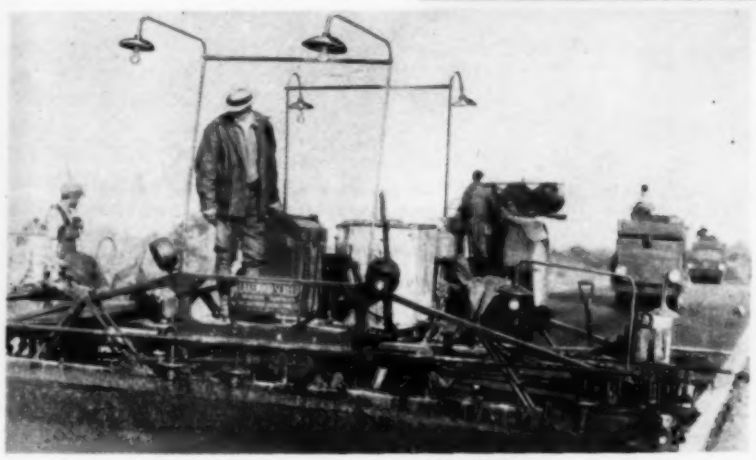
Electric welding was used extensively in shop fabrication of the structural members, but all field connections were riveted because of the expense of field welding in winter. Built-up welded sections of special interest were developed for the main tower columns and

FAST WORK

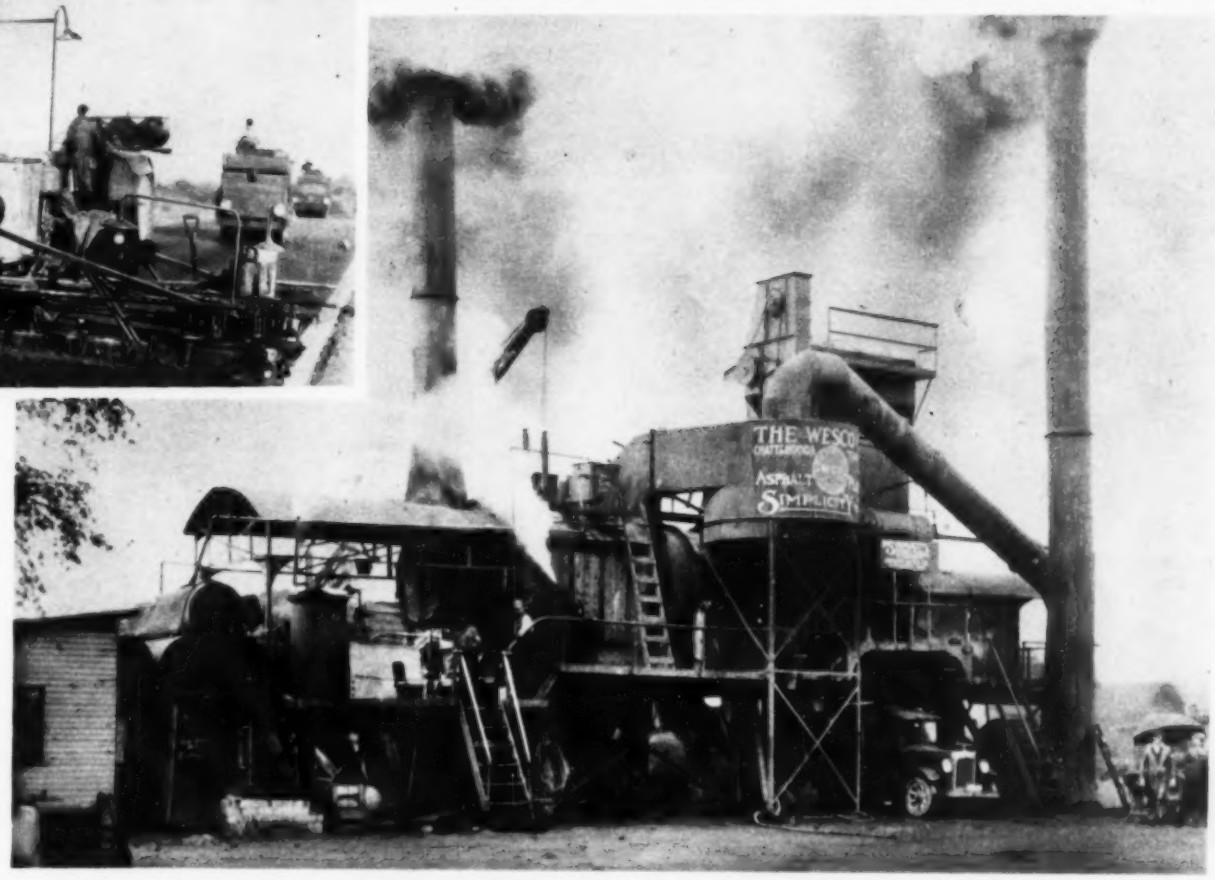
Done in Laying 25 Miles of Black-Top Resurfacing on Widened Ohio Highway

IN a period of 3 months, 4 to 6 weeks of which were practically lost because of bad weather conditions, the Wesco Co., of Chattanooga, Tenn., resurfaced with two-course asphaltic concrete a 24¾-mi. widened section of the Lincoln Highway east of Lima, Ohio. The contractor mixed 40,000 yd. of material for the surface at a single plant set-up in Lima, and hauled the hot batches a maximum distance of 26 mi. in trucks of 5- and 6-ton capacity. Utilization of spreader boxes and a finishing machine aided rapid construction with a small crew.

THREE 10-TON ROLLERS *(right)* and small crew of workmen behind finishing machine complete sealing top course of asphaltic concrete resurfacing.



MECHANICAL FINISHER strikes off material for each of three courses of black-top resurfacing project. Inside-flanged wheels ride on concrete header curbs.



SINGLE SET-UP of asphalt plant equipped with 2,250-lb. mixer box produces 40,000 tons of material for 24¾-mi. job. Maximum haul from plant is 26 mi.

Widening of the old highway called for the installation of a 2-ft. concrete strip on each side with the outer 9 in. of the strip carried up as a header to act as a curb for an asphaltic concrete surface 18½ ft. wide between the headers. The overall width of the completed road is 20 ft. Because of the high crown in the existing pavement, it was necessary to lay wedge courses to reduce the excessive slope from the center line to the edges. On top of this wedge course, the resurfacing called for a base course 1½ in. thick and a 1-in. top course.

During most of the work, the contractor operated two 8-hr. shifts 6 days a week. Toward the end of the project, after cold weather had set in, this schedule was extended to 7 days a week. A West Simplicity asphalt plant equipped with a 2,250-lb. mixing box supplied the asphaltic concrete for the surface. The maximum tonnage produced and laid in two 8-hr. shifts was 940 tons. When working under normal conditions, without weather disturbances, the production approached 2 mi. of finished road every 3 days. The maximum individual run was 1 mi. of 1-in. top in 12 hr.

Several mechanical devices speeded construction of the asphaltic concrete surface and reduced the amount of labor necessary. The trucks dumped the hot material into two spreader boxes which distributed the material approximately to grade. A Lakewood finishing machine equipped with special inside-flanged wheels riding on the concrete headers completed the spreading of material for the wedge course, base course and top course. A new device known as a "compression strip dolly", employed in conjunction with the finishing machine, eliminated the necessity of laying strips on the header curb in advance of the machine to raise the grade of the finished surface and allow for later compression under the rollers. The finishing machine was equipped with special high-speed gears which gave an optional forward speed of 14 ft. per minute. Specifications permitted this speed to be used on the wedge course and the base course and required a speed of 10 ft. per minute on the top course. A crew of four men in front of the finishing machine and two men behind it spread and finished, ready for the rollers, a maximum of 11,500 sq. yd. of top in 12 hr.

Mechanical finishing and skillful operation of three 10-ton rollers employed on the project resulted in a smooth surface, as revealed by the tests of the Ohio Department of Highways prior to acceptance. The contractor started laying black top on Aug. 25, 1932, and finished Dec. 1. M. Russ was general superintendent for the Wesco Co.

Portable Unit Collects

ROCK DRILL DUST

ORDINARY DRILLING raises dust cloud of pulverized rock particles.

ABSENCE OF DRILL DUST is apparent when portable bag-filter collecting unit is employed.

A COMPACT, portable dust-collecting unit, weighing about 130 lb. and designed to take care of one rock drill, was demonstrated by James H. Markley, a foundation contractor, the inventor, and the Spencer Turbine Co., the manufacturer, on March 29 and April 25, at a rock excavating job which Clarence L. Smith, Inc., is performing under subcontract with Allen N. Spooner & Son, Inc., general contractor for three new 1,100-ft. piers being constructed by the Department of Docks of the City of New York. The portable dust-collecting machine works on the bag-filter principle, with an induced draft created by a three-stage exhaust fan. According to the builders, the unit reduces the dust count in the atmosphere around the drill and in the exhaust air below the allowable safe limit and increases the drilling speed by 25 per cent or more.

At the demonstration on April 25, the dust was trapped at the drill by a cylindrical 6-in.-diameter iron hood open at the bottom and covered with a rubber gasket at the top. The rubber gasket contained a hole at the center of the same diameter as the shank of the drill steel, and the rubber was slit in four directions from this center hole to permit passage of the drill bit through the gasket. A short piece of 1½-in. pipe was connected to one side of the cylindrical hood, and the exhaust hose was attached to this outlet. According to a representative of the manufacturer, the vacuum at the hood amounted to about 1¼ in. of mercury. No seal between the hood and the rock surface was necessary, as the vacuum was sufficient to trap all the dust with the inrushing air.

DETAILS of portable dust-collecting unit. Interior *(above)* shown with top removed. Removable pan *(right)* fits on to bottom of machine.

Dust-laden air from the drill passed through the hose into the top of a dust-collecting cylinder at the machine. In this cylinder the air was filtered through the walls of three vertical fabric filter tubes, open at both top and bottom, to the exhaust fan. The fabric tubes stopped practically all the dust, most of which dropped immediately to a collecting pan which fitted into the bottom of the cylinder. A covered hand hole in the wall of the cylinder could be opened to permit the operator to shake the tubes to dislodge any dust collected on the fabric walls.

A motor and fan unit was housed in a cylindrical case attached to the wall of the dust-collecting cylinder. The motor was a Black & Decker ¾-hp. 110-v. universal unit with a speed of 6,000 r. p. m. The suction was created by three fans in series on the same shaft with the motor, with deflectors between the fans. The shaft turns on ball bearings which can be packed with grease sufficient for 6 months operation, and the motor has but two points of lubrication. Power is turned on and off by means of a Crouse-Hinds waterproof toggle switch.

According to the inventor and the manufacturer, units of this type can be built in any capacity up to 40 drills. The larger units would of necessity be stationary. Although an electric motor was used to drive the demonstration model, it also would be possible to power the machines with either gasoline or air motors.

Without Interrupting Service Air-Driven Machine

TAPS LIVE GAS MAIN

WITHOUT interrupting service to its customers in Northern New Jersey, the Public Service Gas Co., of New Jersey, made two 30-in. diameter taps in a live 48-in. main at its plant in Harrison in order to provide a by-pass in the line, which runs overhead from the furnaces to large gas holders and serves a million persons with 40,000,000 cu. ft. of gas daily. In the by-pass line it was necessary to install an automatic valve to shunt overloads of gas into the holders instead of through the usual intermediate operations.

The work was done under the general direction of H. H. Ferris, general manager of the Public Service Gas Co., of New Jersey.

At the point where the first of the two taps had to be made while full gas pressure was maintained continuously, the main is approximately 20 ft. above ground. The operation called for this first tap to be made vertically, upwards, into the underside of the main—a most unusual condition. The A. P. Smith Mfg. Co., of East Orange, N. J., was called upon to do this work, using its gas tapping machines handled by experienced operators. Each of the two taps 30-in. in diameter was made without difficulty in less than 4 hr.

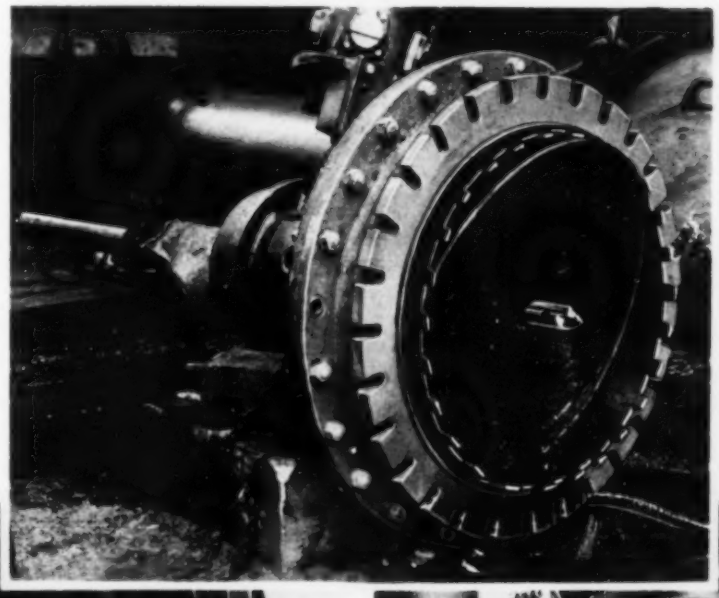
The first work was to weld a steel hat-flange to the bottom of the main, where the first cut was to be made. To this flange a special 30-in. tapping valve was bolted permanently, and to this valve the Smith tapping machine was attached temporarily.

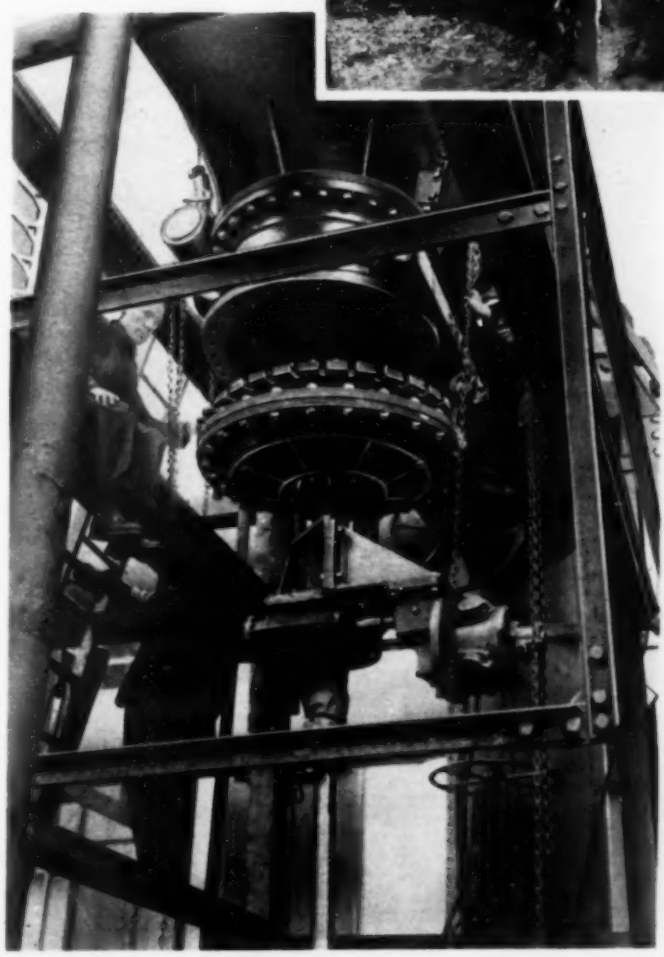
With the gate of the valve fully opened, the cutting mechanism of the tapping machine was advanced upwards through the valve until it came in contact with the wall of the pipe to be cut.

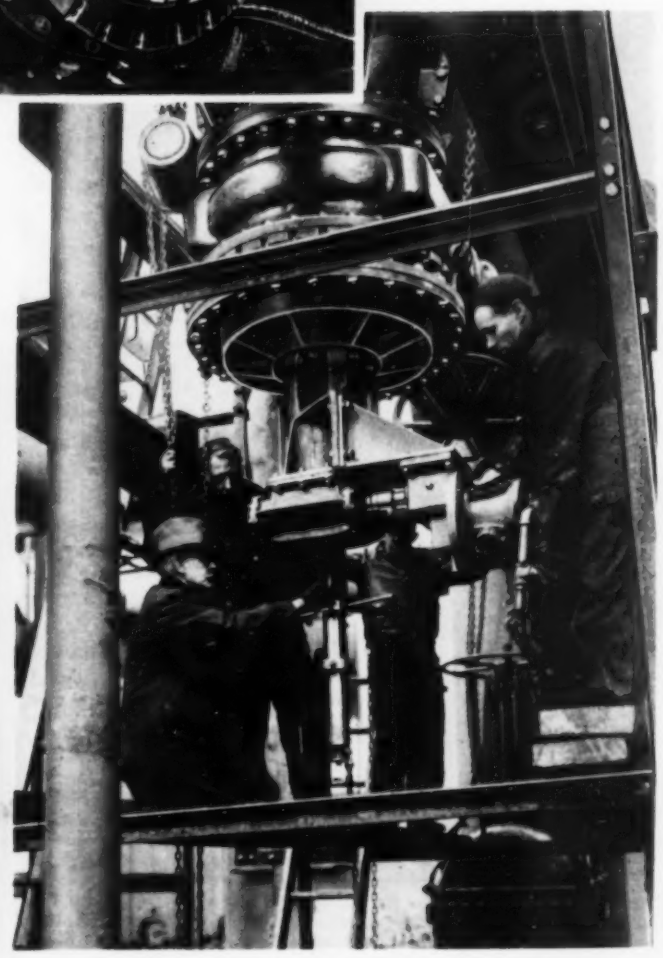
The cutters of the tapping machine are preceded by a drill of relatively small diameter, the function of which is to provide lubrication, an outboard bearing, and a way to withdraw the disk readily after the latter has been cut from the pipe wall. The actual cutting was done by air power using a compressor and a flexible rubber hose to an air motor forming a part of the machine.

It required not more than an hour's cutting to complete this part of the operation, after which it was an easy matter to lower the cutting mechanism, with the cut-out disk, down through the special tapping valve. The valve then was closed and the entire tapping machine removed. Later, a companion tap was made at another point in the main and the two were connected by a by-pass main.

The use of compressed air, a comparatively new development in A. P. Smith tapping operation, was of special value in this work. To have employed either steam or gasoline for power would have presented at least two major difficulties. Either would have required a foundation, power belting and adjustments to meet the exact position of the tapping machine when raised high into position. Either would have presented a serious fire or explosion danger as a result of open flame or sparking.







RAISING tapping machine 20 ft. to point of use underneath 48-in. live main.

CUTTING HEAD *(at top)* of machine, with disk cut from pipe wall.

MAKING CUT with special machine operated by compressed air through open valve.

NEW EQUIPMENT

TO CUT DRILLING COSTS. Removable rock drilling bit, replacing conventional bit forged on end of hollow drill steel, is made of high-carbon alloy steel. It is held tightly against an upset shoulder on the drill steel by a special left-hand thread opposed to the direction of rotation of the steel, so that the bit is kept tightly against the shoulder while drilling. Hammer blow is transmitted from steel through shoulder to body of bit, no force being absorbed by thread. When bit becomes dull, it is detached and replaced by new one. Sizes: 1¼- to 2-in. gages for ⅞-in. hex and 1-in. round steel diameters; 1⅜- to 2⅝-in. gages for 1-in. hex and 1-in. round steel diameters; and 1¾- to 3-in. gages for 1¼-in. round steel diameters.—Timken Roller Bearing Co., Canton, Ohio.

SCRAPER, GRADER AND BANK SLOPER *(below)* combined in this bottomless scraper which may be used as a hauling unit for moving earth from 300 to 400 ft.; for spreading earth that has been dumped on fills; for grading in close quarters; for leveling; and for grading, sloping and smoothing banks. Made of heavy plates, box-type sections, and scientifically designed electric welded bowl with special oscillating feature. Double edge, reversible cutting blade bolted to bottom of bowl is easily removed or reversed. Hydraulic power for operating scraper provided by oil pump placed on tractor power takeoff. Scraper cutting depth, 1 to 12 in. Spreading depth, 1 to 18 in. Capacities, 3, 5, 5½ and 6 cu. yd. — La Plant-Choate Mfg. Co., Cedar Rapids, Ia.

TWO-STAGE, AIR-COOLED COMPRESSOR, in portable unit, delivers 23 per cent more air at 100-lb. pressure and requires 25 per cent less gasoline per foot of air than single-stage compressor of same piston displacement. Has two low pressure cylinders arranged in a V and between them, in vertical position, a high pressure cylinder. Between first and second stage, compressed air passes through air-cooled intercooler where it is cooled practically to intake temperature, resulting in greater air delivery, a saving in power, better lubrication and elimination of carbon. Powered by Waukesha 4-cylinder heavy-duty gasoline engine. Made in four sizes with piston displacements of 125, 185, 250 and 370 cu. ft. per minute. Advantageous for general service, especially for high altitudes and hot climates.—Ingersoll-Rand Co., Phillipsburg, N.J.

CONCRETE FINISHING BROOM *(right)* made in conventional 4-row type of bass or bassine fibre and fitted with adjustable handle-bracket permitting adjustment of handle tilt to conform to the Illinois state specifications. Made in variety of widths and sizes with standard 12-ft. steel tube handle.—L. and M. Manufacturing Co., 10298 Berea Road, Cleveland, Ohio.

on the Job

DITCHING WITH MOTOR GRADER *(below)* made possible by use of wide front axle leaning wheels and full dual drive. Machine has six speeds forward ranging from 1.39 to 13 m.p.h. Full dual drive puts all power to work. Four drive wheels grip surface to provide freedom from wheel slippage and miring. Front axle 80 in. wide resists side draft, increases stability and makes machine easier to handle. Z-bar gooseneck has machined ball joint (non-chatter) draft connection. Can be equipped with power controls and diesel motor. — The Austin-Western Road Machinery Co., 400 N. Michigan Ave., Chicago, Ill.

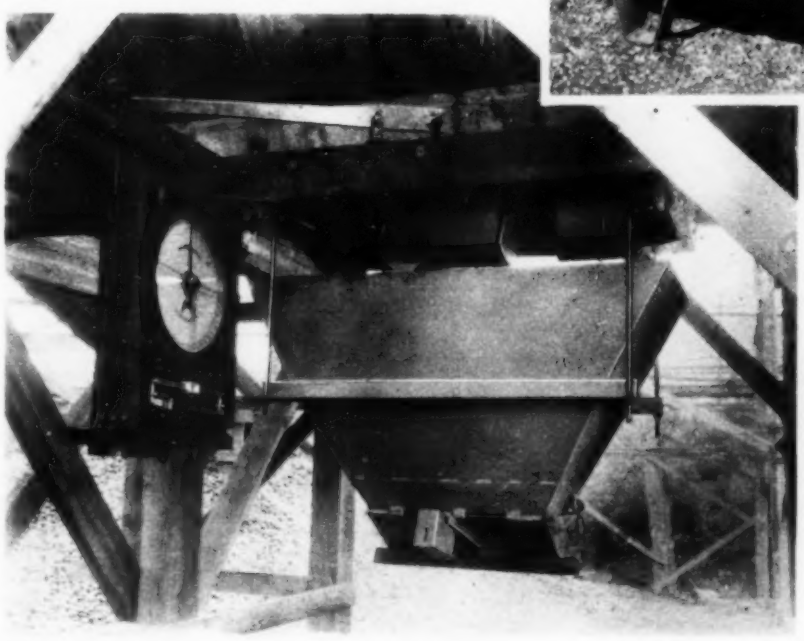
20,400-GAL. PER HOUR is capacity of this Rex portable 3-in. self-priming pump which is 34 in. high, 37 in. wide and weighs 385 lb. Machine incorporates self-priming device known as "prime control," which permits adjustment of pump's recirculating system to assure maximum capacity and minimum priming time on any suction lift. Impeller of open trash type with two blades enables pump to handle high percentage of solids and to pass a sphere up to 1½ in. in diameter. Pump and engine mounted on wheelbarrow frame. May also be had in 2- and 2½-in. sizes with capacities at 5-ft. suction lifts of 10,800 to 13,000 g.p.h. respectively. — Chain Belt Co., Milwaukee, Wis.

If You Want Further Information—

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.

VERSATILE POWER CUTTER FOR CONSTRUCTION MATERIAL. With motor head which may be turned to any angle in vertical plane, mounted on a slide which may be turned to any angle in a horizontal plane, Multiplex cutting machine provides for accurate cutting at vertical or horizontal angle or combination. Head is arranged to receive a wide variety of cutting tools for doing nearly every woodworking job, including sawing, routing and shaping. In addition, tools are available for cutting slate, metal, brick, tile, and composition material. Frame of alloy steel, malleable iron and heat treated aluminum assures strength and provides lightness and easy portability. Samples of materials cut shown in insert at left. — Red Star Products Corp., Sta. D., Cleveland, Ohio.



FOR SPEEDING UP WEIGHING of concrete aggregates for batch mixing. Dial scale *(left)* utilizes pipe lever system of 5-ton pitless scale mounted in an 8-in. channel frame from which is suspended a 20-in. portable dial graduated 5,000 lb. by 5 lb. for 1-yd. batch or 10,000 by 10 lb. for 2-yd. batch. Blank bar provided for balancing hopper. For weighing each ingredient, dial is equipped with special aluminum indicators. When scale is mounted on top of mixer, hopper is extended up through the lever system; when hung below bin, hopper is suspended below levers, permitting channel iron frame of scale to be bolted directly to timbers beneath bunkers.—Fairbanks, Morse & Co., 900 South Wabash Ave., Chicago, Ill.

Present and Accounted For —

A Page of Personalities

Underwood & Underwood

TENNESSEE VALLEY AUTHORITY. Arthur E. Morgan, president of the Dayton Morgan Engineering Co., and president of Antioch College, Dayton, Ohio, has been appointed by President Roosevelt, chairman of the board of administrators of the Tennessee Valley Authority, created by recent act of Congress. Mr. Morgan is an authority on flood control and land reclamation and served as chief engineer of the Miami Conservancy District.

WORLD'S FAIR MANAGER. Major Lenox R. Lohr has been serving as general manager for Chicago's Century of Progress Exposition, which was officially opened to the public this month. Formerly an officer in the Corps of Engineers, U. S. Army, Major Lohr has had supervision over the extensive construction program involved in preparing grounds and buildings for the World's Fair.

PROMOTED TO CHIEF ENGINEER. Philip Harrington, formerly assistant, is now chief engineer of the Sanitary District of Chicago, with which he has served since graduation from Armour Institute of Technology in 1906.

CONTRACTOR-DIRECTOR. A. P. Greensfelder, past-president of the Associated General Contractors of America and president of the Fruin-Colnon Contracting Co., of St. Louis, Mo., has been elected a director of The Chamber of Commerce of the United States.

A.G.C. CHAPTER PRESIDENT Lynn S. Atkinson, of Los Angeles, well known Pacific Coast contractor, builder of the Coolidge and the Pardee dams, has been elected president of the Southern California Chapter, Associated General Contractors of America.

152 PLANES OF AMERICAN AIRWAYS, *Inc.*

rely on the SINCLAIR BIG 8

Now comes still another proof of the ability of the 8 great Sinclair refineries to manufacture high quality lubricants. The 152 planes of the American Airways, Inc., one of America's biggest air transport companies, now just switched to Sinclair. Henceforth the 152 planes and other service equipment of this corporation will be Sinclair lubricated. American Airways serves 75 cities and 20 States in the United States and two provinces in Canada. It is the only airline having routes from coast to coast and Canada to Mexico. Each day its planes fly 37,697 miles.

This is impressive proof of Sinclair quality and economy—particularly when added to the fact that 150 American railroads, the United States Navy and many other public as well as private enterprises have been long-time users of Sinclair oils. The 8 Sinclair refineries are now using 50 basic oils from which they manufacture some 200 brands—each adapted to some particular need of industry or transportation.

Sinclair Engineering service is at your command. Call or write our nearest branch office or any local Sinclair Agency. Sinclair Refining Company (Inc.), New York, Atlanta, Chicago, Houston, Fort Worth, Kansas City. Sinclair Refining Company of California, Los Angeles.

Tune in Monday evenings 38 NBC Stations—SINCLAIR MINSTRELS

SINCLAIR

INDUSTRIAL OILS **MOTOR OILS** **TRACTOR OILS** **GREASES**

The New Blaw-Knox TRUKMIXER is the last word in all around efficiency, long life and low cost » » »

This is the unit that enables contractors, building supply dealers and ready mixed concrete plants to make worth while profits even with limited use. The Blaw-Knox TRUKMIXER is built to serve the average contractor's needs and is so economical that it is a paying investment even in a dull season. The TRUKMIXER is made to last; maintenance costs are practically eliminated.

A Blaw-Knox engineer can prove to you with figures taken from your own local conditions and set-up, that a TRUKMIXER will be a profitable investment. Will you ask for this demonstration even if you are only curious; there is no obligation involved.

The Blaw-Knox improved TRUKMIXER is made in the following sizes:—

AS A MIXER—1, 1½, 2, 3, 4 and 5 cubic yard capacities.

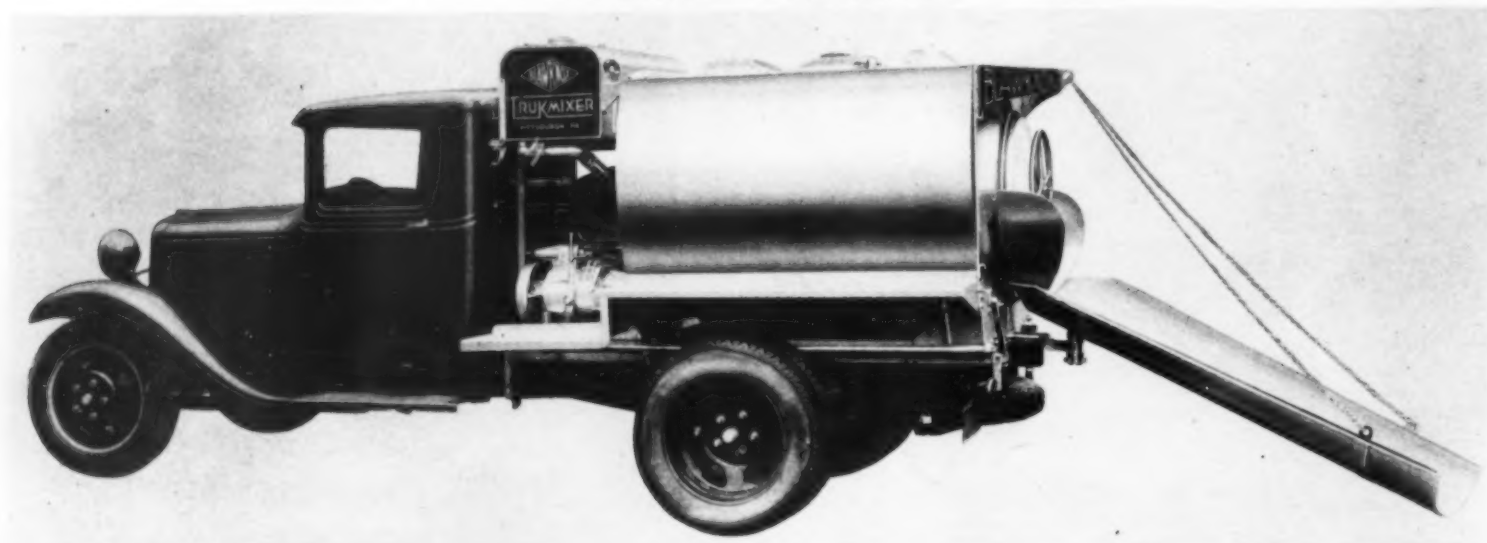
AS AN AGITATOR—1, 2, 3, 4, 6 and 7 to 8 cubic yard capacities.

Phone—wire or write

BLAW-KNOX COMPANY

2086 FARMERS BANK BUILDING PITTSBURGH, PA.

Offices and representatives in principal cities.



BLAW-KNOX

The Blaw-Knox Low Cost DIRTMOVER . . .

The song of the Blaw-Knox (Ateco) Hydraulic DIRTMOVER is **cheap dirt,** lower and lower cost per yard.

Yardage costs such as $.0495 per cubic yard, and lower, dependent upon length of haul—are a matter of common record. We would like to tell you about contractors who are making real money out of all kinds of dirt moving jobs.

Ask about the low cost DIRTMOVER.

The Blaw-Knox Hydraulic BULLDOZER . . .

—moves more dirt at less cost.

The rigid box type of construction conserves tractor power by an amazing reduction in Bulldozer weight without sacrifice of strength.

Easy and quick to put on—two way control, with positive downward pressure on the curved digging bowl—speedy bulldozing.

The hydraulic power which operates the digging bowl is concealed in the sidearm—away from dust and dirt.

Send for Bulletin No. 1394.

Other items of construction equipment in which Blaw-Knox leads.

Road Forms—Batcherplants—Clamshell Buckets—Steel Forms for Concrete Construction—Bulk Cement Plants—Ready Mixed Concrete Plants—Truck Mixers—Dirtmovers—Wagon Graders—Tamping Rollers—Bulldozers—Scarifiers—Concrete Buckets—Portable Asphalt Plants.

MANEUVERABILITY

WELLINGTON attributed his victory at Waterloo to the "maneuverability" of his armies; contrasted with the fixed formations and inflexible advances of Napoleon's troops. Wellington's forces charged, retreated, engaged in maneuvers that spelled victory to the British Arms.

• Machines, like armies, to operate effectively and economically, should possess that same quality. In fact, Cletrac crawler tractors can out-maneuver anything made by man—or by nature—except perhaps the elephant and the mountain goat.

• Cletrac's unmatched maneuverability is due to one thing, a patented and exclusive feature—a feature on which foreign makers have insisted that they be licensed before building crawler tractors. *That feature is Cletrac's Controlled Differential Steering which gives full power on both tracks when turning.* Only Cletracs have this feature which permits full use of the engine power at all times.

Better Be Safe than Sorry
See what Cletrac Gives before You Buy

We make crawler tractors exclusively. Model 80, the world's most powerful automotive unit, and other horsepower ratings of 55-35-25 and 20.

THE CLEVELAND TRACTOR COMPANY
Cleveland, Ohio, U. S. A.

Cletrac 80, carving new highways in Ohio.

Cletrac
Crawler Tractor
REG. U.S. PAT. OFF.

ITS MARK

Industrial Cletracs
Model 80, $4650.00 Model 55, $3600.00
Model 35, $2475.00 Model 25, $1850.00
Prices F. O. B. Factory include electric starting equipment.

7 pumps failed on this job

Seven pumps—each claimed by its maker to be superior to a LaBour—were tried and found wanting on this well point job, used in building the Lawrence Avenue grade separation on the Outer Drive, Chicago. The Warner Construction Co., contractors, put a No. 20 Type WPD LaBour pump to work, and this solved their pumping problem.

This LaBour pump, equipped with a 5-hp. engine, handled 56 standard 1¼-inch well points, kept the water 8 feet below the level of nearby Lake Michigan, and discharged through 700 feet of 4-inch pipe against a total head (pressure gauge) of 49½ feet. The points were 10 feet deep in the sand. It is all filled ground, and the sand was constantly blown about so that it was necessary to clean the carburetor of the pump engine every day—a fact which was one of the causes of failure in plunger type pumps, which were rapidly cut out by sand.

When you buy a LaBour you buy performance. There isn't anything "just as good," as more than one contractor has learned to his sorrow and expense. This job was a real show-down of claims and promises, and of all the pumps that tackled it, only the LaBour made good.

For further information and details about the complete line of LaBour pumps for contractors' service, write the factory at Elkhart.

THE LABOUR CO., INC.

609 Sterling Ave.

ELKHART, INDIANA

TYPE WPD

This No. 35 Type WPD unit, on pneumatic tires, is but one of the wide range of LaBour pumps for contractors. Tell us your problem, and we can recommend the pump best suited for your purpose.

This FREE BOOK

explains a new technique in blasting that has resulted in more work from each charge, shorter loading hours, easier removal and lower hazard. Send for a copy.

The Ensign-Bickford Company, Simsbury, Connecticut

CORDEAU BICKFORD

DETONATING FUSE

JAEGER SURE PRIME PUMPS

$165.00

BUYS 10,000 GAL. SIZE COMPLETE

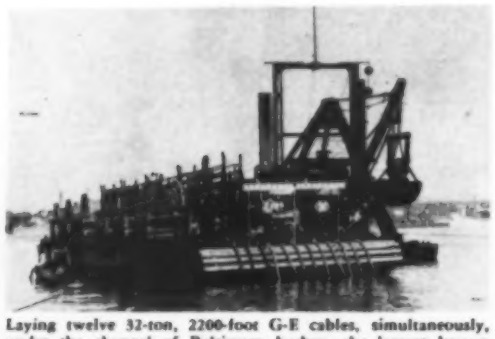
BUILT IN 2", 3", 4", 6" SIZES

America's fastest selling line of contractors' pumps.
Write for new catalog, new low prices.

THE JAEGER MACHINE CO. 800 Dublin Ave. Columbus, O.

Make YOUR Bid STRONGER

Include G-E INSULATED CABLE



Laying twelve 32-ton, 2200-foot G-E cables, simultaneously, under the channel of Baltimore harbor—the largest known installation of its kind

The *Marshall C. Harris*, one of the world's largest electric dredges. G-E cable was installed by the Pacific Electric Motor Co., Oakland, Calif. Builders: Golden State & Iron Works

G-E INSULATED CABLE

VARNISHED-CAMBRIC

Standard braided and leaded
Transformer leads
Apparatus
Switchboard wire

GLYPTAL-TREATED CLOTH

This oil-resisting, heat-resisting, long-life insulation is available for cable for special applications, in the same types and sizes as varnished-cambric-insulated cable. Ask for recommendations.

RUBBER

Standard braided and leaded
Parkway and rural-service
Mining-machine and gathering-reel
Station and traffic-control
Train and jumper
Portable
Dynamo and brush-holder
Car cables
Motor leads
Arc-welding
Neon-sign
Tree wire
Service-drop (standard)
Service-drop (theft-proof, concentric)
Bracket-lead
Hot-bed
Trolley-coach
Corona-proof

PAPER

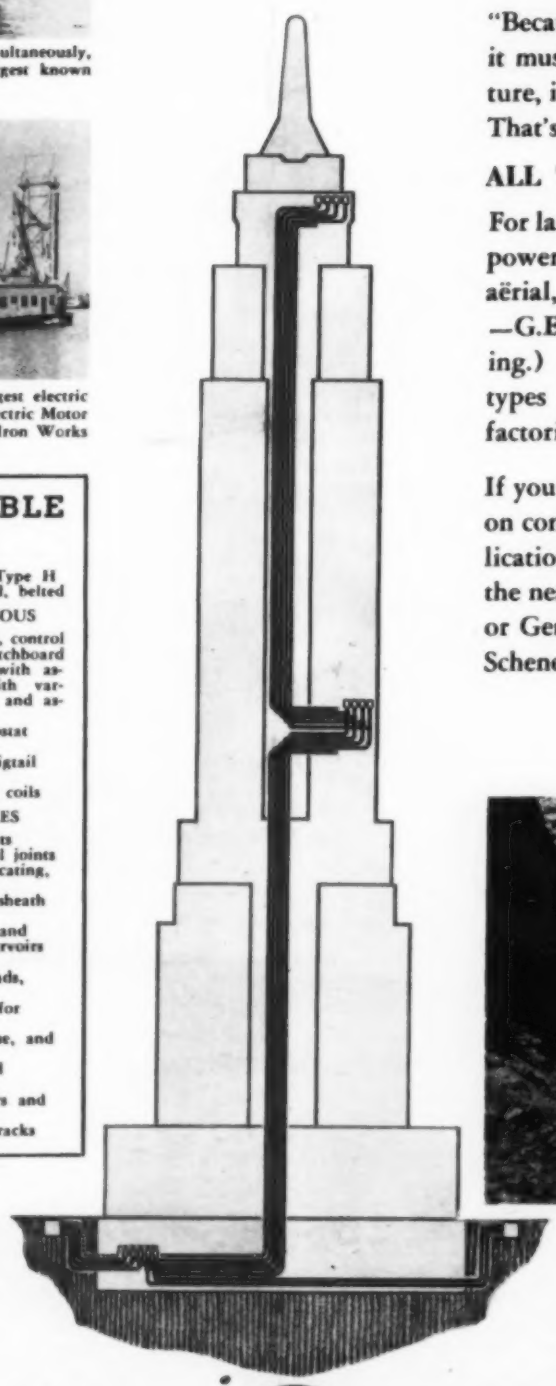
Oil-filled
Solid, shielded, Type H
Solid, nonshielded, belted

MISCELLANEOUS

Station, apparatus, control cable, and switchboard wire insulated with asbestos and with varnished cambric and asbestos
Nonignitable rheostat leads
Braided copper pigtail leads
Magnet wire and coils

ACCESSORIES

Unit package joints
Straight or normal joints
Bifurcating, trifurcating, and stop joints
Split and normal-sheath insulators
Pressure, feeder, and conservator reservoirs and fittings
Terminals, potheads, end bells
Spreader castings for terminals
Coupling, tee, fuse, and junction boxes
Splicing tapes and compounds
Portable degasifiers and oil pumps
Adjustable cable racks



For the 13,200-volt primary feeders in the Empire State Building, G-E engineers designed a special varnished cambric-insulated cable. All other cables in the building are G.E., too. Electrical contractors: L. K. Comstock & Co. Builders: Starrett Bros. and Eken, Inc.

EVERY type of this cable has talking points that will help you get the business.

You can say: "G-E cable has been used for many jobs, and you can be sure that in each case a thorough study was made of all types before the cable was finally chosen.

"Because cable is so important, and because it must usually last for the life of the structure, it doesn't pay to put in any but the best. That's why we specified G. E."

ALL TYPES—PROMPT SHIPMENTS

For large jobs and small—for buildings, ships, power stations, construction work—for aërial, underground, and submarine service—G.E. can supply the right cable. (See listing.) Promptly, too, because most standard types and sizes are carried in stock in G-E factories and warehouses and by distributors.

If you are interested in portable cable for use on construction jobs, write for two new publications, GEA-1728 and GEA-1733. Address the nearest G-E distributor or G-E sales office, or General Electric Company, Dept. 6-201A, Schenectady, N. Y.

For portable work on construction jobs, specify G-E tellurium-compounded all-rubber cable. Above is one of the many electric shovels on the great Hoover Dam project that are served by this tough cable. Contractors: Six Companies, Inc.

810-33

GENERAL ELECTRIC

STEEL LINER PLATES

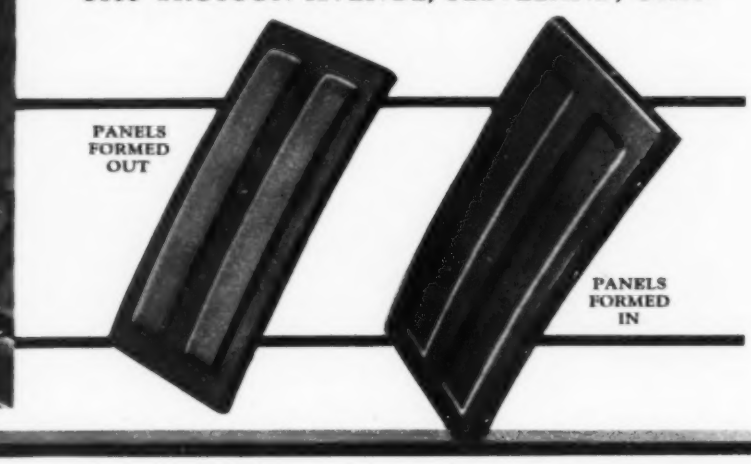
for underground work

An ideal product for speedy and economical construction of tunnels, subways, sewers, shafts, caissons, foundations and similar construction. Expensive shoring is eliminated and excavation is reduced to a minimum. No danger of cave-ins or lost headings, no worry about ground conditions. The Liner Plates are formed under tremendous pressure to any radius or contour and require merely bolting together. Engineering Data Book on request.

TRUSCON STEEL COMPANY

PRESSED STEEL DIVISION

6100 TRUSCON AVENUE, CLEVELAND, OHIO

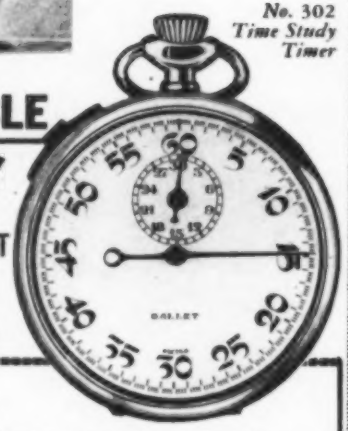


Saved **MOMENTS-**

Saved **MOTION-**

Saved **MONEY!**

No. 302 Time Study Timer



USE A DEPENDABLE STOP WATCH!

GUINAND & GALLET STOP WATCHES

Recognized standard for accuracy the world over!

JULES RACINE & CO.,
20 West 47th Street, New York

Kindly forward catalog CMJ showing Timers for road-work use.

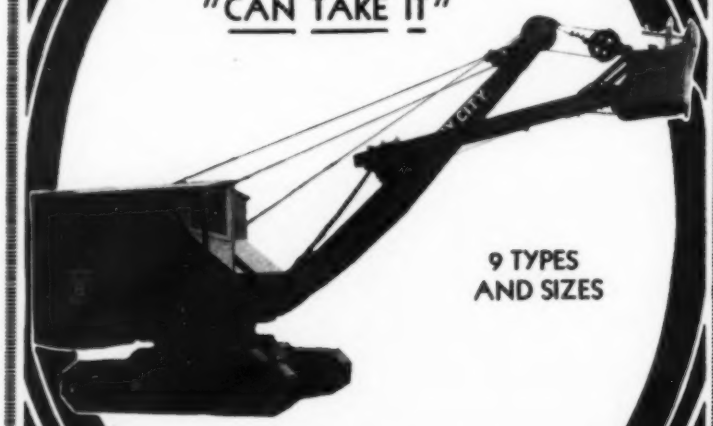
Name .....

Address ..... *City* .....

BAY CITY

The Machines That

"CAN TAKE IT"



9 TYPES AND SIZES

3/8-yd.—Part Circle or Full Circle
1/2-yd.—Standard or Heavy Full Circle
3/4-yd.—Standard or Heavy Duty
1-yd.— " " " "
1 1/4-yd.—Standard 3 to 18 Ton Cranes

MODERN DESIGN
Honestly Advertised — Fairly Priced
— FOR 20 YEARS —
Builders of Dependable Shovels — Cranes — Dredges

BAY CITY SHOVELS, Inc.

BAY CITY, MICH.

How one simple tire change will save you many dollars this year

WANT to add 20% to 35% more traction — more speed to your maintainers? Want to save 18% to 20% on gasoline and oil bills? Want to cross punctures, blow-outs and tire maintenance troubles off the list forever?

Then read these quick facts about this remarkable new tractor tire . . . this new kind of tire that contractors and road builders everywhere are buying.

What it is

The Goodrich Zero Pressure Tire represents an entirely new principle of tractor tire construction. It requires no air pressure. Thus it *can't* go flat. The bouncing action of pneumatics is eliminated, giving a smooth powerful grip —in all kinds of going—that excels even the traction of a lug wheel. Yet the cushioning effect of Zero Pressures is so far superior to other tires that they greatly increase the life of equipment and save many dollars in repair bills.

Surprisingly low price

Yet with all these remarkable advantages Zero Pressure Tires cost surprisingly little — far less even, than many pneumatic tires!

Add to this the fact that they greatly outwear all other type tires. Then ask yourself just this one question: "Can I afford to put off making this simple tire change a single day longer when I know it's one sure way of cutting costs 'way down—saving real money, right away?

FREE! Don't delay. Phone your nearest Goodrich distributor now for the complete facts. Look up his name under "Tires" in the classified telephone directory. Or send for the specially prepared free booklet, "Goodrich Zero Pressure Tires". Address Dept. Z-13, The B. F. Goodrich Rubber Company, Akron, Ohio.

Goodrich *Zero Pressure* Tires

SPECIFY ZERO PRESSURE ON ALL YOUR MAINTAINERS

The OPENING GUN *has been* FIRED!

The Administration's program for the revival of industry has advanced to the point where the country can expect a *resumption of public works construction this summer.* Unnecessary obstructions which have delayed us in the past must, says the President, be over-ridden by prompt and vigorous action.

Surveys show there are thousands of projects upon which action has been postponed. These projects, valued at more than $3,000,000,000, are ready to go forward. Many will call for bids at an early date. Contract letting will go ahead as rapidly as Government funds are released.

Highway construction, with its ratio of nearly 4 men to supply each man in the front lines, is an important factor in the public works program. Water-works, sewage disposal, bridges, tunnels, municipal power and light, irrigation, reclamation, flood control, docks, parks, structures—all these are represented also in the construction work that is ready to start at once.

PUBLIC WORKS CONSTRUCTION STARTS THIS SUMMER

The engineering-construction industry, comprising 45,000 engineers and contractors, will administer the job after Washington arranges the financing. Alert equipment and material manufacturers will strengthen their selling contacts with the entire industry *right now!* No one can foresee which engineering firms, which contractors will get the jobs. No one can contact each individual member of the industry with two-legged salesmen alone. Two-fisted advertising in *Engineering News-Record* and *Construction Methods* is the safe and economical solution. A continuous summer campaign in these two publications is the one best bet. We will gladly cooperate in helping you and your advertising agent plan effective copy.

Engineering News-Record • Construction Methods

McGraw-Hill Publications **330 West 42nd Street, New York**

FAST-PORTABLE
Multiplex
FOR WOOD AND METAL WORKING

SAVES ITS COST MANY TIMES A YEAR

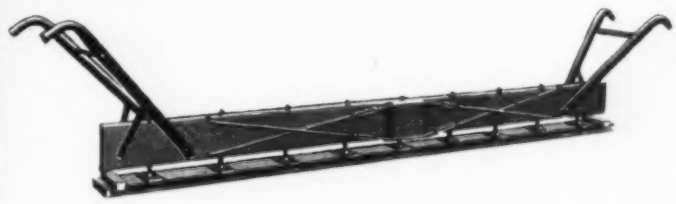
Cross cutting—beveling—ripping—mitering—bevel cross cutting and ripping—compound mitering—dadoing—tenoning — mortising — shaping — ploughing—

Multiplex performs all these operations on wood with cost slashing speed. Also cuts *metal, slate, brick, tile, wall board, gypsum.*

Speedy — portable — easy to change from one type of work to another—you need this tool. Add it to your equipment—now.

RED STAR PRODUCTS CORPORATION
STATION D
CLEVELAND····· OHIO

GIANT-GRIPT WATER RATIO BULL FLOATS



Cut from seasoned knot-free cypress and fir, GiantgripT Water Ratio Bull Floats have the right build and weight for the harsh and dry concretes in water-ratio mixes.

Steel adjusting studs between upright and base members permit easy adjustment for straightness and eliminate constant planing. Dadoed hardwood end cleats resist warp.

Upright member is steel trussed and turnbuckled so that line-straightness may be easily maintained. Steel-braced oaken plowhandles are adjustable to suit operator's height.

Working surfaces are ground to straightness and oil-treated. Upright portions are brilliantly orange-enameled to waterproof.

Available in every length and width to meet state specifications everywhere.

Fully described in new Catalog No. 5. Just off the press! Send for it!

L and M Manufacturing Company
10298 Berea Road—Cleveland, Ohio

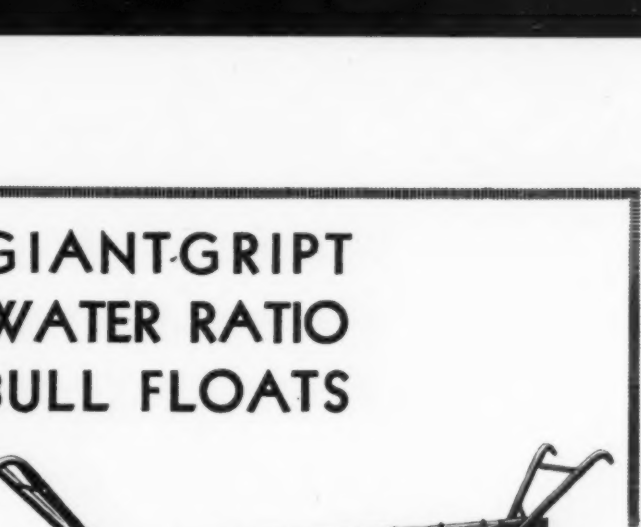
Makers of the famous GIANTGRIPT *Straightedge*

NOVO-Helps To Successful Contracting

Construction Methods that have proven successful will interest you, that's why we are giving you these glimpses of Novo Equipment in operation.

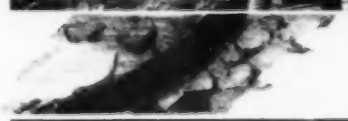
As you know, we also have a complete line of Diaphragm, Pressure and Plain Centrifugal Pumps, Construction Hoists and Lighting Plants. Use the coupon for full information. BUY NOVO.

Territories open for commission salesmen, write for details.



Here is a Novo 3" Self Primer doing the tough job of dewatering a sewer excavation on a river bank—a high head with large volume of water. BUY NOVO.

This Novo 2" Self Priming Centrifugal Pump has the surprising capacity of 7500 gallons per hour—is mounted on handy trucks—has the Novo "fool-proof" leather seal. BUY NOVO.



A "one man" Novo Dragline Hoist outfit—cheapest method known for taking out sand and gravel—single operator takes out 600 cu. yards of aggregate per day. BUY NOVO.

NOVO
PUMPS — ENGINES — HOISTS

NOVO ENGINE COMPANY
214 Porter Street Lansing, Michigan

CHECK THE COUPON NOW

Name..... Address.....

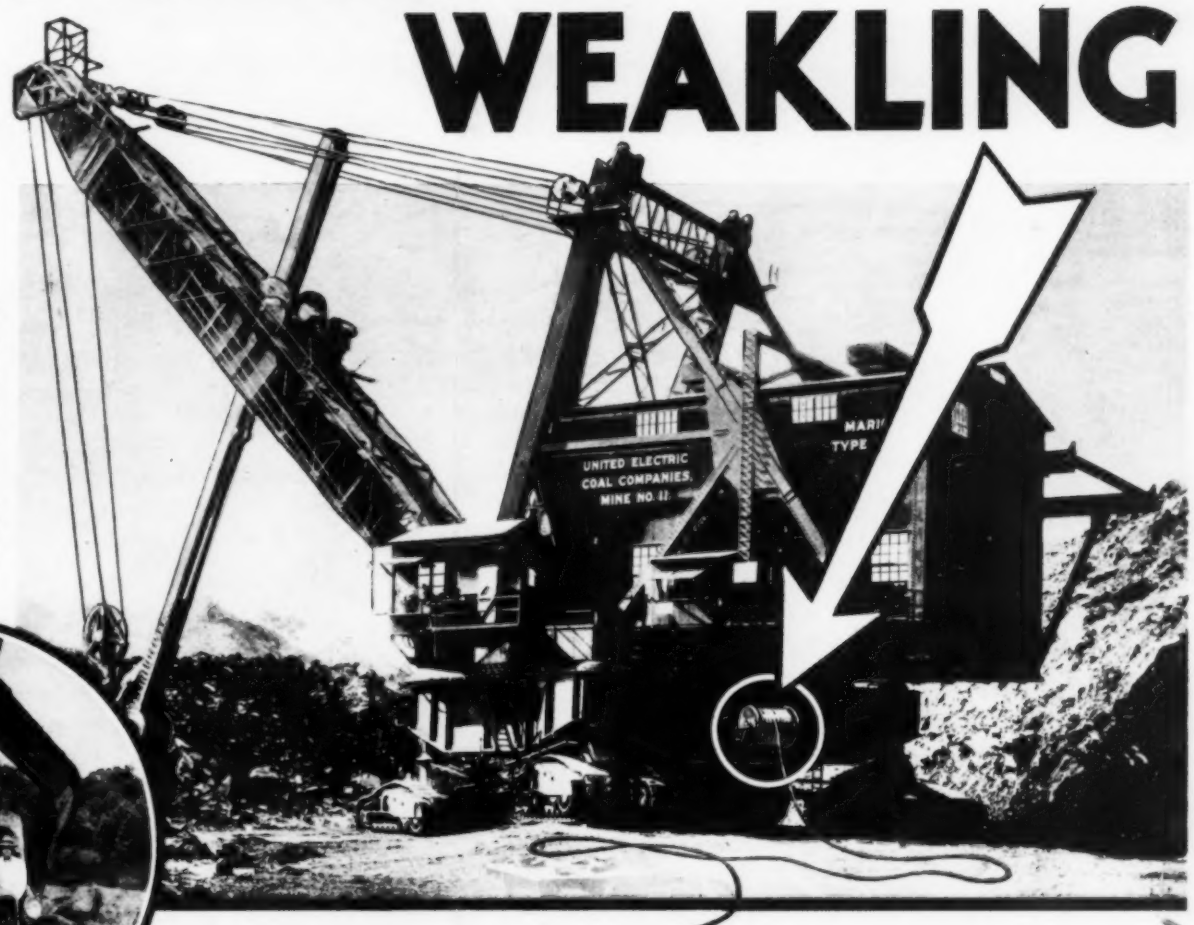
- ☐ Self Priming Centrifugal Pumps
- ☐ Diaphragm Pumps
- ☐ Dragline Hoists
- ☐ Plain Centrifugal Pumps
- ☐ Road Pumps
- ☐ Flud-Lite Lighting Units
- ☐ Pressure Pumps

ALPHABETICAL INDEX TO ADVERTISERS

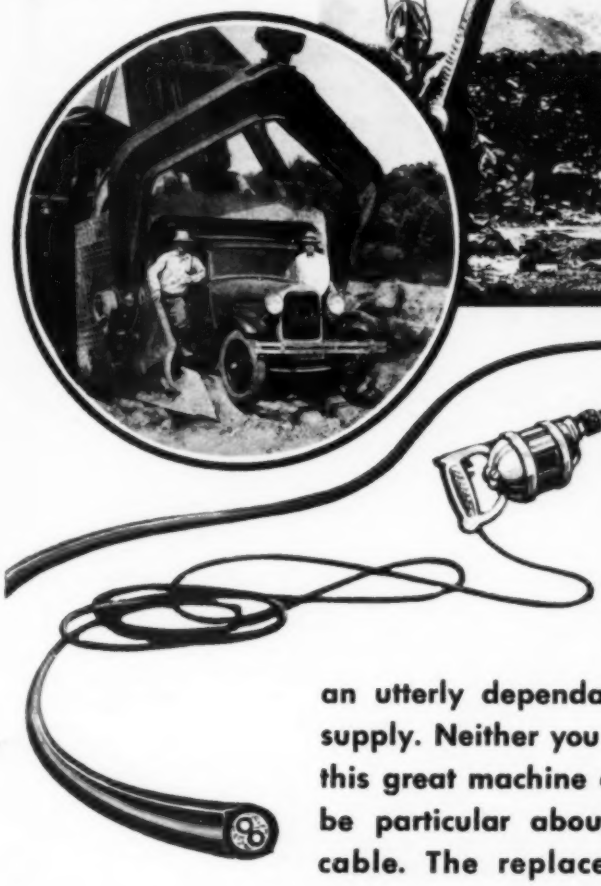
This index is published as a convenience to the reader. Every care is taken to make it accurate, but *Construction Methods* assumes no responsibility for errors or omissions.

SEARCHLIGHT SECTION

NO PLACE for a WEAKLING



This greatest of shovels, with a 15 yd. dipper on an 83 ft. stick in a 120 ft. boom receives its 5,000 volts through SUPER SERVICE portable cable. Consider the use, the strains, the abrasion it must withstand. It lives up to its responsibility.



Your Smallest Electric Tool ...and this Monster Shovel

They have one thing in common —the need for an utterly dependable electric power supply. Neither you nor the owners of this great machine can afford NOT to be particular about portable electric cable. The replacement cost of the cable itself, of whatever size, is trifling compared with the time loss and annoyance of a "dead" or "shorted" line . . . . . Specify and order SUPER SERVICE by name and be sure of a long-lived, trouble free portable cord or cable. Kink-Proof — Abrasion Resisting — Non-Crushable.

U. S. Pat. 1,865,415
1,865,416

SUPER SERVICE

The Portable Power Cable that's tougher than your job for it.

Available through supply houses everywhere—or from

GENERAL CABLE CORPORATION

420 LEXINGTON AVE., NEW YORK, N.Y. Offices in Principal Cities